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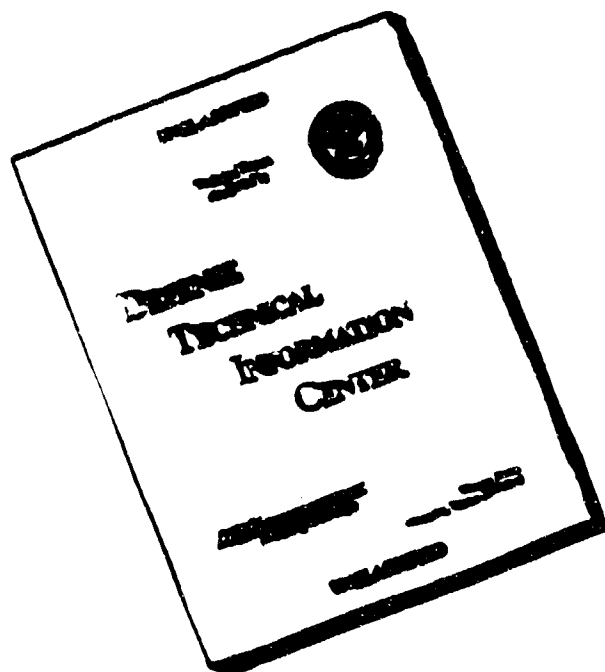
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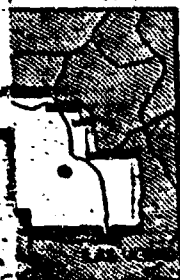
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Report to the Test Director

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TECHNIQUES S.R.D. (8)**

⑨ NA

By

The Nucleonics Department

⑩ NA

⑪

17 Jul 59,

Approved by: R. L. CORBIE

Director, Program 39

Director, Civil Effects Test Group

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ABSTRACT

Physical measurements of gamma-radiation dose, as a function of distance from the point of detonation, were made on 18 shots of Operation Plumbbob.

Standard-Du-Pont-and-Eastman dental film packs housed in film-badge holders designed by Edgerton, Germeshausen & Grier, Inc., were used to make the measurements.

The results of measurements taken in various shelters and in experimental structures are also presented. The data are arranged in tabular form by project number and shot name.

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ABSTRACT

Physical measurements of gamma-radiation dose, as a function of distance from the point of detonation, were made on 15 shots of Operation Plumbbob.

Standard De-Pont and Eastman dental film packs housed in film-badge holders designed by Edgerton, Germeshausen & Grier, Inc., were used to make the measurements.

The results of measurements taken in various shelters and in experimental structures are also presented. The data are arranged in tabular form by project number and shot name.

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We are also indebted to those persons in the Nucleonics Department who did not participate directly in the operation but who performed innumerable supporting functions.

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Chapter 1

INTRODUCTION

1.1 OBJECTIVE

The objective of Project 39.1a was to ensure that the various Civil Effects Test Group (CETG) projects were able to obtain and document in an economical manner adequate radiation measurements to accomplish their goals. This objective was accomplished by measuring the integrated gamma dose at points along the ground and at various locations in selected structures. In addition, fallout measurements and other special data (found in the Appendix) were supplied to some non-CETG projects.

1.2 BACKGROUND

The film-taping technique designed and used by Edgerton, Germeshausen & Grier, Inc., (EG&G) on Operation Teapot was employed again during Operation Plumbbob. With this technique individual pieces of film are taped together to form a convenient reel equivalent to 35-mm motion-picture film. Some advantages of this system include ease of processing, analysis, and storage.

The sensitometric analysis methods employed on Operation Teapot were also used. A description of the methods can be found in Report WT-1174 (see also Operation Greenhouse Report WT-81).

Chapter 2

PROCEDURE

2.1 SHOT PARTICIPATION

On Operation Plumbbob the film-badge dosimetry measurements were made primarily for CETG projects. Instrumentation was located in the field to determine dose vs. distance (RD^2 vs. D) for a given shot. Total integrated measurements were also made in shelters and in various experimental structures.

2.2 CALIBRATION

A Co^{60} gamma calibration system was arranged so that three sets of 10 badge assemblies were consecutively exposed to doses ranging progressively from 0.05 to 5×10^3 r. An extension of the high-range curve based on a calibration made at Los Alamos Scientific Laboratory (LASL) was used to increase the maximum readable dose to 5×10^4 r. The calibration source (7 curies) was placed in a cradle at one end of a calibration table oriented so that the center of the source beam passed through the center of the badges.

Badge distances were determined with a 25-r Victoreen chamber that had been recently calibrated by the National Bureau of Standards (NBS). Exposures were timed to obtain mid-scale readings for greatest accuracy. It is believed that an over-all reproducibility of better than 5 per cent was maintained on administered doses.

Actual shot calibrations were made the morning of D-day, using film badges that were assembled and handled with the field badges. Shot badges were placed in the field the afternoon before the shot and were recovered when Rad-Safe opened the area. The film badges were not allowed to remain in the field more than three days before a shot. All badges were developed together, with sensitometric scales spaced at intervals throughout the reel. Ranges covered by the dosimeter films were:

Du Pont 502	0.1 to 10 r
Du Pont 510	8 to 300 r
Du Pont 606	200 to 600 r
Eastman SO-1112	300 to 5×10^4 r

Film irradiated in the field tends to darken beyond the density obtainable with gamma calibration alone when it is processed to a gamma of 1.3. Several theories have been proposed by various groups and individuals as to the exact physics or mechanics of this process. Some of the causes proposed are (1) differential rate sensitivities between laboratory and field conditions, (2) neutron effects at distances close to Ground Zero (GZ), (3) thermal effects,

(4) overdarkening due to activation irradiation, (5) a mechanical factor brought out by the low-gamma processing, and (6) the possibility of visible or low-energy X-ray fluorescence.

It is the intent of EG&G to resolve this discrepancy, whether it is due to the above listed anomalies or to some other factor or combination of factors, before the next field participation.

2.3 FILM-BADGE HANDLING

After recovery of the film badges from the field, the film packets were arranged in numerical order in a special dispenser and individually fastened together in the EG&G-designed edge-taping machine. After being taped on this machine, approximately 200 complete badges, or 800 pieces of film, could be assembled on a single reel and processed together in the same manner as standard 35-mm motion-picture film.

When the processing operation had been completed, the density of each film was measured on a densitometer. The equivalent roentgen exposures were determined from the density readings with the curves that were made from the calibration badges. The readings were then related according to the proper film-badge number and were transferred to the data sheets for analysis.

2.4 FILM PROCESSING

Owing to high-range restrictions and errors inherent in reading high doses from the plateau area of the calibration curve, which would be noticed in Eastman SO-1112 film under normal development procedures, the badges were processed to a wide-latitude gamma of 1.3. This wide-latitude gamma easily extends the range of the SO-1112 film to approximately 5×10^4 r and yields a slope compatible with reasonably accurate differential dose measurements. Although more control is required in the actual developing phase when development is not carried to completion, the advantage outlined above seemed to warrant this procedure.

Included with the cobalt calibration badges were several SO-1112 white-light standards. All badges were run through the taping machine and were developed as follows:

Emulsion type MF, No. 1112; MCS 5000; N.D. 1.3
Developer: D-76, No. 4
Temperature: 70°F
Time: 2 min 39 sec; 10 double-squeegee wipers used at a speed of $8\frac{1}{2}$ ft/min
Gamma: 1.30

2.5 ANALYSIS

The reels of processed badges were mounted on rewinds and wound across the reading surface of an Ansco-Macbeth color densitometer (model 12). Central readings were made and recorded for each film. After the completion of a series of readings, usually involving one set of calibration films and a large number of unknowns, the calibration films were plotted as density vs. dose curves. The unknowns were then evaluated. In most cases each reel, for control purposes, was supplied with several sensitometric scales throughout its length, along with the proper gamma calibration films. After evaluation, reels of badges were placed in 35-mm canisters and properly labeled for storage.

Chapter 3

DATA

No attempts have been made to correct the data presented in this report for neutron sensitivity, thermal sensitivity, and film "lot" reproducibility. The following limitations are brought to the reader's attention:

One occurrence that does have a pronounced effect on film dose measurements in the field is the difference in saturation density between the laboratory exposures and field exposures. On a density vs. log exposure curve, the straight-line portion of the curve is longer for field exposures than for laboratory exposures, and the saturation density is higher for field exposures than for laboratory exposures. This difference appears to be related to differential rate sensitivities between laboratory and field conditions. Since we have no quantitative data on this effect, our procedure has been to ignore, or at least to use skeptically, all measurements above a specifically selected straight-line portion of the curve. All data reported have been extracted from calibration curves where dose does not exceed this point on the straight-line portion of the curve.

The neutron sensitivities of the several types of films used in the EG&G film badge are reported to vary by a factor of 2 from the least sensitive to the most sensitive. Film sensitivity varies from batch to batch and also with the type of packaging. In view of these uncertainties and in view of the fact that the film type is seldom listed in weapons test reports, we are suggesting an average value for film neutron sensitivity in making corrections to film-badge gamma measurements. The values that have been used by the Air Force Special Weapons Center are 3.4 per cent of the high-energy neutron rep dose (measured by Hurst fission-foil detectors) plus a response to thermal neutrons of 3.6×10^5 thermal neutrons/cm (measured by gold foils) for a film response of 1 r. These two corrections are additive. In general, the maximum correction for neutron sensitivity is about 10 to 30 per cent of the gamma dose; thus the errors introduced by using average sensitivity values are not important.

An experiment was conducted under controlled conditions in an attempt to evaluate the effects of environmental desensitization of the film. The scant data collected suggest that there was desensitization, but insufficient data are available to yield adequate correction factors.

A least-squares analysis was performed on all the distance-dose measurements in an attempt to better appreciate the validity of the collected data. However, it was soon realized that, because no corrections were made for the fast-neutron, thermal-neutron, and differential rate sensitivities of the film, this manipulation was somewhat meaningless.

A total of 2958 film badges was issued by EG&G for use by CETG on Operation Plumbbob.

3.1 FRANKLIN

EG&G placed two stake lines from 500 to 1500 yd, at 100-yd intervals, to the north; and 525 to 1525 yd, at 100-yd intervals, to the south of GZ. Badges were also supplied to CETG for

placement on paralleling "goal posts" in Project 39.5, Oak Ridge National Laboratory (ORNL), blast containers ("beer-mug" containers).

The RD^2 vs. D curves are given in Figs. 3.1 and 3.2, and the data are given in Tables 3.1 and 3.2.

The badges remained in the field for two days before the shot and were recovered on the afternoon of D-day. Since EG&G's calibration system was not yet completed, a series of badges calibrated by LASL and processed with the EG&G shot badges was used for evaluation of the Franklin data.

A representative series of calibrations is included with the Franklin data in Figs. 3.3 to 3.6. Subsequent intercomparison of EG&G and LASL calibrations produced curves that were almost identical. Limitations imposed by the small EG&G source made necessary a range extension by use of some LASL calibration points. Since a major portion of the two curves was superimposable, the calibration extension was considered valid.

Figure 3.7 indicates the useful portion of the calibration curves (solid lines).

3.2 WILSON

One film badge per point was placed from 400 to 2000 yd on the southeast 204" goal-post line by Project 39.1b/39.5 in ORNL beer-mug containers.

The RD^2 vs. D curve for these data is given in Fig. 3.8, and the RD^2 vs. D computations are given in Table 3.3.

The badges were placed in the field the night before the shot, but they remained outside a day and a half after the shot before they were processed. EG&G calibration badges, for processing with the shot film, were handled in the same manner, and their curves were used for interpretation.

3.3 PRISCILLA

The calibration curve of the Priscilla film badges was based on the extended LASL calibration and an extrapolation to estimate extremely high doses. This extrapolation was based on previous experimentation that indicated the general shape of the calibration curve from 5×10^4 to 5×10^5 r.

"Extremely high" doses were those for which it was not possible to obtain densities by Co^{60} irradiation alone in the standard EG&G holder. Indications were that fast and thermal neutrons first overshadow the gamma radiation at about 2×10^4 r and continue to darken the film beyond the maximum densities obtainable by Co^{60} calibration. This continued darkening was opposed to film reversal or lightening after about 4×10^4 r of gamma radiation alone when processed to a gamma of 1.3.

These results indicate that proper analysis of high-dose mixed irradiation fields will necessitate adequate neutron calibration and application of corrective factors.

Figure 3.9 shows the RD^2 vs. D slope for the stake line, and the data are given in Table 3.4.

The shelter drawings (Figs. 3.10 to 3.18) indicate film-badge locations in the various Priscilla structures. Figure 3.10 shows the positions of the structures relative to GZ and to each other.

In general, two film badges were placed at each location designated by "+": one badge at 3 ft from the floor and another at 5 ft. To indicate which dose was received by a specific badge, a line was drawn from the + and the dose that was recorded by the badge placed at 5 ft was written above the line; the dose received by the badge placed at 3 ft was written below the line.

3.4 HOOD

The goal posts placed by EG&G for Hood shot were from 750 to 2000 yd east of GZ. Instrumentation at the 750- and 2000-yd positions was not recovered.

In addition to the EG&G badges in hangers, the same types of film were placed in thermal-neutron-shielding lithium cans mounted in beer-mug type containers on the goal posts. A special calibration indicated that the badges in the lithium cans did not differ widely (dose vs. density) from those placed in the standard EG&G container. The RD^2 vs. D curves for these measurements are shown in Fig. 3.19, and the data are given in Table 3.5.

The badges were placed in the field three days before the shot, and they were recovered on zero morning.

3.5 DIABLO

A goal-post line was run from 500 to 1600 yd north of GZ (goal posts were placed at each 100 yd) to the Project 32.3 manned shelter. The RD^2 vs. D curves for the film badges and film in lithium cans are shown in Fig. 3.20, and the data for these curves are given in Table 3.6.

The exterior and entranceway to the shelter were monitored with EG&G film badges; the doses received are shown in Fig. 3.21. Twenty stakes were driven into the ground blanketing the surface of the shelter. The film badges were taped to the stakes at a 3-ft height and were wrapped in the thermal-protective aluminum foil.

Special-study badges were placed on a stake line paralleling the goal posts.

The goal-post and shelter badges were placed in the field three days prior to the detonation and were recovered the afternoon of D-day. Calibration curves used in data interpretation of Diablo badges were handled in a manner similar to those for the shot badges. All calibrated badges were irradiated the morning of the shot and were processed with the field badges, as were all EG&G shot calibrations.

3.6 KEPLER

The main study on Kepler shot was the instrumentation of an animal shelter (Project 33.1) located approximately 340 yd from GZ. Forty-five points within the shelter were monitored. The dose interpretation of these badges is given in Fig. 3.22.

Three goal posts were placed at 500, 1000, and 1500 yd from GZ to obtain an approximate dose vs. distance (RD^2 vs. D) curve (Fig. 3.23 and Table 3.7) for the initial gamma measurements. Film badges in EG&G hangers and in lithium cans, as well as CETG chemical dosimeters and ORNL neutron detectors, were mounted on these goal posts.

The goal-post badges were placed in the field two days prior to, and were recovered the morning of, the shot.

3.7 STOKES

For Stokes shot EG&G film badges were placed on goal posts at 250-yd intervals from 750 to 2000 yd from GZ. Lithium cans containing films were placed at 750, 1000, 1250, and 1500 yd from GZ. The RD^2 vs. D curve is shown in Fig. 3.24, and the data are given in Table 3.8.

3.8 SHASTA

Four film badges were placed on each goal post at 750, 1000, 1250, and 1500 yd from Shasta GZ. The RD^2 vs. D curve for Shasta is shown in Fig. 3.25, and the data are given in Table 3.9.

In addition, the Project 32.3 manned shelter was again monitored with EG&G film badges, as was done for the Diablo shot. A drawing of the shelter used for Shasta, with dose interpretation, is shown in Fig. 3.26.

No calibration was made for this shot; the Stokes calibration was used because of identical processing controls.

3.9 DOPPLER

EG&G film badges were placed on goal posts at 250-yd intervals from 750 to 2000 yd from GZ. Lithium cans were located at points from 750 to 1500 yd from GZ. A comparison of the two types of dosimeters is shown in Fig. 3.27 and in Table 3.10.

The dosimeters were placed in the field the day before the shot and were recovered during the morning of the shot. As in Shasta, the Stokes calibration was used owing to the similarity of processing controls.

3.10 FRANKLIN PRIME

Film badges in EG&G hangers were placed on goal posts at 250-yd intervals from 500 to 1750 yd from GZ. Lithium cans and other special-purpose badge containers were used at points from 500 to 1250 yd. The RD² vs. D curves for film badges and film placed in lithium cans are shown in Fig. 3.28, and the data are given in Table 3.11.

Franklin Prime dosimeters were placed in the field the day before the shot and were recovered the morning of the shot.

3.11 SMOKY

Out of a total of 16 shelters on Smoky shot, an arrangement of 14 shelters designed in France (Project 30.6) and Germany (Project 30.7) was tested as part of the CETG structures program. This cooperative program was originated with the intent of strengthening NATO civil-defense relations as well as providing specific indoctrination and orientation into weapons effects.

A hill and dale dosimetry program was conducted to produce data on the effect of geographical terrain on prompt-gamma-radiation doses.

Heavy instrumentation of the 16 underground shelters, i.e., five French, nine German, and two Holmes and Narver (H&N) shelters, was accomplished by the use of EG&G film packs, which were placed in the shelters to measure prompt-gamma-radiation doses at various locations within the shelters. Recovery was made in all shelters. Project 39.1b/39.5 neutron detectors were used to supplement this gamma information.

The data are presented in tabular form and in drawings of the shelters. The sketches show the dose received as a function of badge location. Data from the neutron detectors are also presented on some of the plan drawings to facilitate gamma vs. neutron comparison.

In the shelter drawings the following information is given:

Figure 3.29 is a layout showing distances with respect to GZ of French and H&N shelters to the left, and German to the right, of the blast line. The preshot estimated psi levels are also given.

Figures 3.30 to 3.44 are plans of the French, German, and H&N shelters, indicating points of instrumentation and respective results. Doses in roentgens for American film badges are shown, for all the shelters, above the line drawn to the film-badge symbol for badges 5 ft from the floor and below the same line for badges 3 ft from the floor.

Sulfur and gold neutron-flux detector readings are presented in Figs. 3.31 and 3.32 for the French shelters and in Figs. 3.37 and 3.40 for the German shelters. Readings, which are given above the line for sulfur and below the line for the gold-cadmium difference, are in neutrons per square centimeter.

Positions only are noted for germanium detectors (Project 37.4).

To compare French and American dosimetry techniques, French film plates and EG&G badges were placed together in the five French shelters used on Smoky. Each French plate consisted of eight film packs of various types taped to a piece of Plexiglas and wrapped in packing material covered with a dust-tight plastic bag. The EG&G pack consisted of four types of film in a polyethylene case mounted in a lead and tin box.

French film types used were as follows:

Type	Range, r (accurate portion of curve)	
	American process (approximate)	French process (approximate)
Kodak Periapical (K-P)		
a	2-200	0-2
b	2-200	100
Chassende Baroz 600 R (CB-600 R)		
a	20-500	150
b	20-1,000	600
Chassende Baroz 50,000 R (CB-50,000 R)		
a	100-10,000	1,000
b	200-40,000	10,000
c	5,000-70,000	40,000

Film types used by EG&G were:

Type	Range, r (accurate portion of curve)
Du Pont Film Pack, Type 553	
Type 502	5-12
Type 510	8-250
Type 606	200-600
Eastman SO-1112	300-50,000

Two film packs on each French plate had a cadmium strip covering part of the packet. Table 3.12 gives French (cadmium readings) and EG&G dosimetry comparisons.

All French films were processed with the American dosimeters to a gamma of approximately 1.3.

French control films placed in standard EG&G badges were irradiated and developed to furnish calibration curves for the dose interpretation of the plates. It was thought that some of the French control film had been calibrated, but, since no means of identification could be found, these badges could not be distinguished from fresh film. Therefore a random series of K-P and CB-600 R badges was cut in half and made lighttight. One series of these half-badges was then irradiated and processed with the other, nonirradiated (control), half. The results indicated that the Kodak badges chosen were all originally fresh film, and, since the controls showed no darkening above normal, a good calibration curve was obtained. Since some discrepancies appeared on the CB-600 R films, it was necessary to run two calibrations to obtain a curve. The CB-50,000 R film calibration looked very satisfactory, and the doses interpreted from the plates in the shelters indicated these doses to be in fair agreement with the American dosimeters.

A set of the remaining French badges was calibrated for processing in France to compare French and American processing techniques. Kodak Periapical calibration packs were placed in EG&G containers and were irradiated from 0.01 to 500 r on the EG&G Co⁶⁰ calibration range, and the administered dose was written on the packs; the remaining Kodak packs that were returned were not irradiated.

Also included for return to France were nonirradiated controls plus irradiated CB-600 R films (with doses from 0.5 to 500 r irradiated in the same manner as the Kodak film) and CB-50,000 R films (with doses from 100 to 5×10^3 r).

As a final step in preparing film plates for return, all processed French films were mounted on clear plastic sheets, labeled, and bound in book form with a table of contents, thus making it possible to reread film densities directly from the pages without removing the films.

A study was made in an attempt to better understand the part played by the geographical structure of hill and dale terrain on prompt-gamma-radiation doses. Film badges were placed in special containers and attached to a ground cable or mounted on goal posts in various directions from GZ.

Figure 3.45 shows the elevation to the north with respect to the tower, GZ, and point A. Table 3.13 gives the slant-range calculations for the north line, and Table 3.14 gives the RD^2 vs. D data.

Figure 3.46 indicates graphically the elevations to the northeast of GZ. Table 3.15 indicates the slant-range calculations for this line. Table 3.16 contains the RD^2 vs. D information, and Table 3.17 gives the iron-pipe container data.

A blast container made of standard 3-in. iron pipe with a capped end and eyebolt for the cable attachment was used to hold EG&G film badges along the contours of the ground on the northeast line.

Only the ground doses were interpreted from two special iron-pipe calibrations. The doses recorded for the shot were determined from these calibration curves.

Table 3.18 presents the slant-range calculations for the south goal-post line, and Table 3.19 contains the RD^2 vs. D information.

3.12 GALILEO

For the Galileo shot, EG&G film badges and Project 39.1b/39.5 neutron dosimeters were placed on a stake line along the east access road and in an animal shelter (Project 32.1). The stake line ran 1218 to 3400 yd from GZ. The RD^2 vs. D graph for stake-line badges is given in Fig. 3.47, and the data are given in Table 3.20.

The animal shelter was located approximately 300 yd south of GZ. Readings for these shelter film-badge dosimeters are given in Fig. 3.48.

All instrumentation was placed the night before the shot and was recovered the morning of the shot.

3.13 LA PLACE

EG&G film badges were placed on goal posts at 250-yd intervals from 500 to 1500 yd beside the main access road leading to La Place GZ. All instrumentation was set up the day prior to the shot and was recovered the morning of the shot. The RD^2 vs. D curves for the lithium cans and EG&G containers are shown in Fig. 3.49, and the data are given in Table 3.21.

3.14 FIZEAU

EG&G film badges on goal posts at 200-yd intervals from 800 to 1600 yd from GZ were the only dosimeters used by EG&G on Fizeau. The RD^2 vs. D curves of this instrumentation are in Fig. 3.50, and the data are in Table 3.22.

The badges were placed in the field the day before the shot and were recovered the morning of the shot. Ideal conditions made this essentially a fresh film test.

Results of measurements made for Project 39.6a are given in Tables 3.23 and 3.24.

3.15 WHITNEY

Whitney film badges were placed at 250-yd intervals on a stake line from 750 to 1750 yd from GZ. The RD^2 vs. D curve for these badges is shown in Fig. 3.51, and the data are given in Table 3.25. Badges were placed in the field two days before shot time and were recovered the morning of the shot.

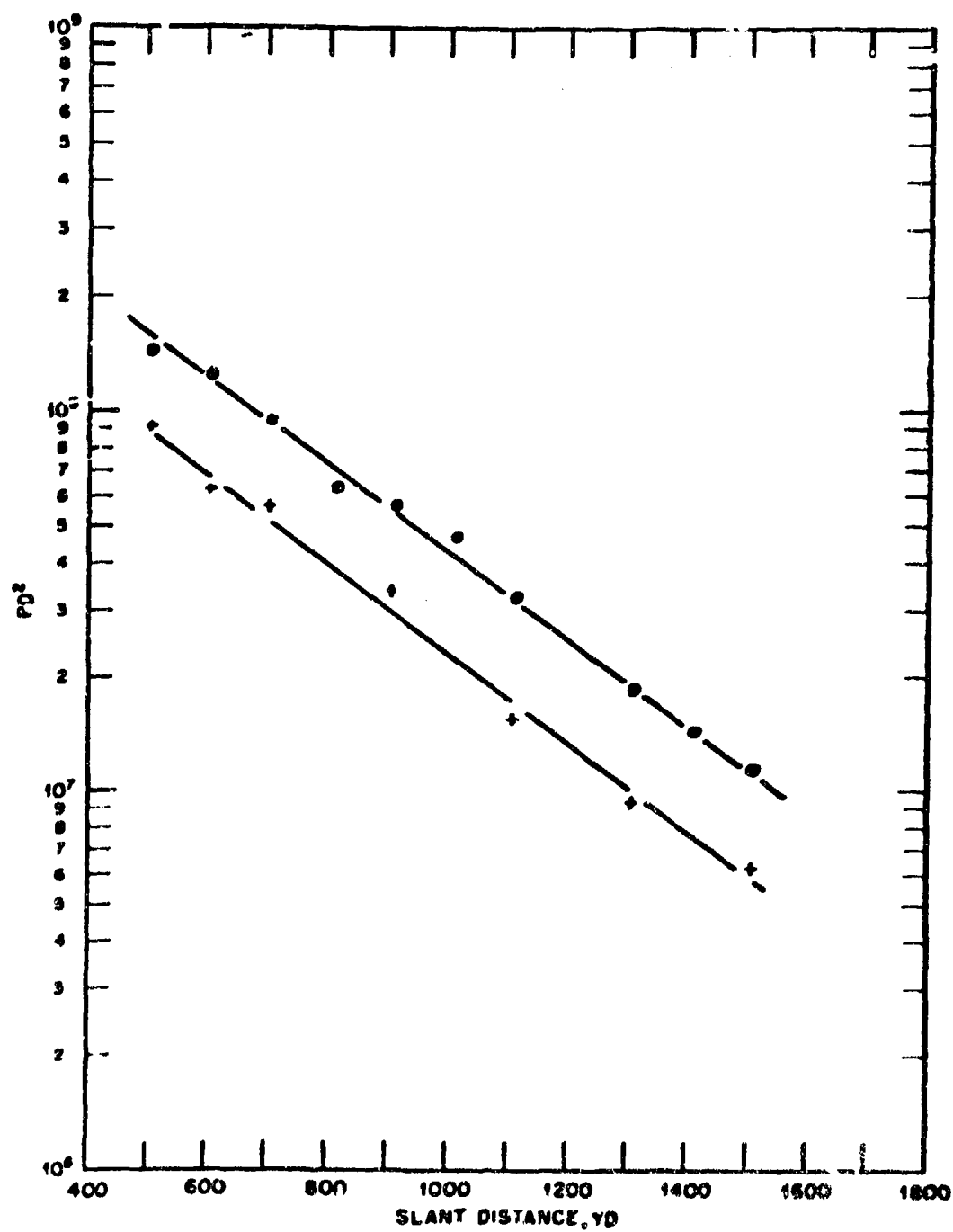


Fig. 3.1 — Franklin, north line, KD^2 vs. D . O, stake-line badges. +, goal-post badges.

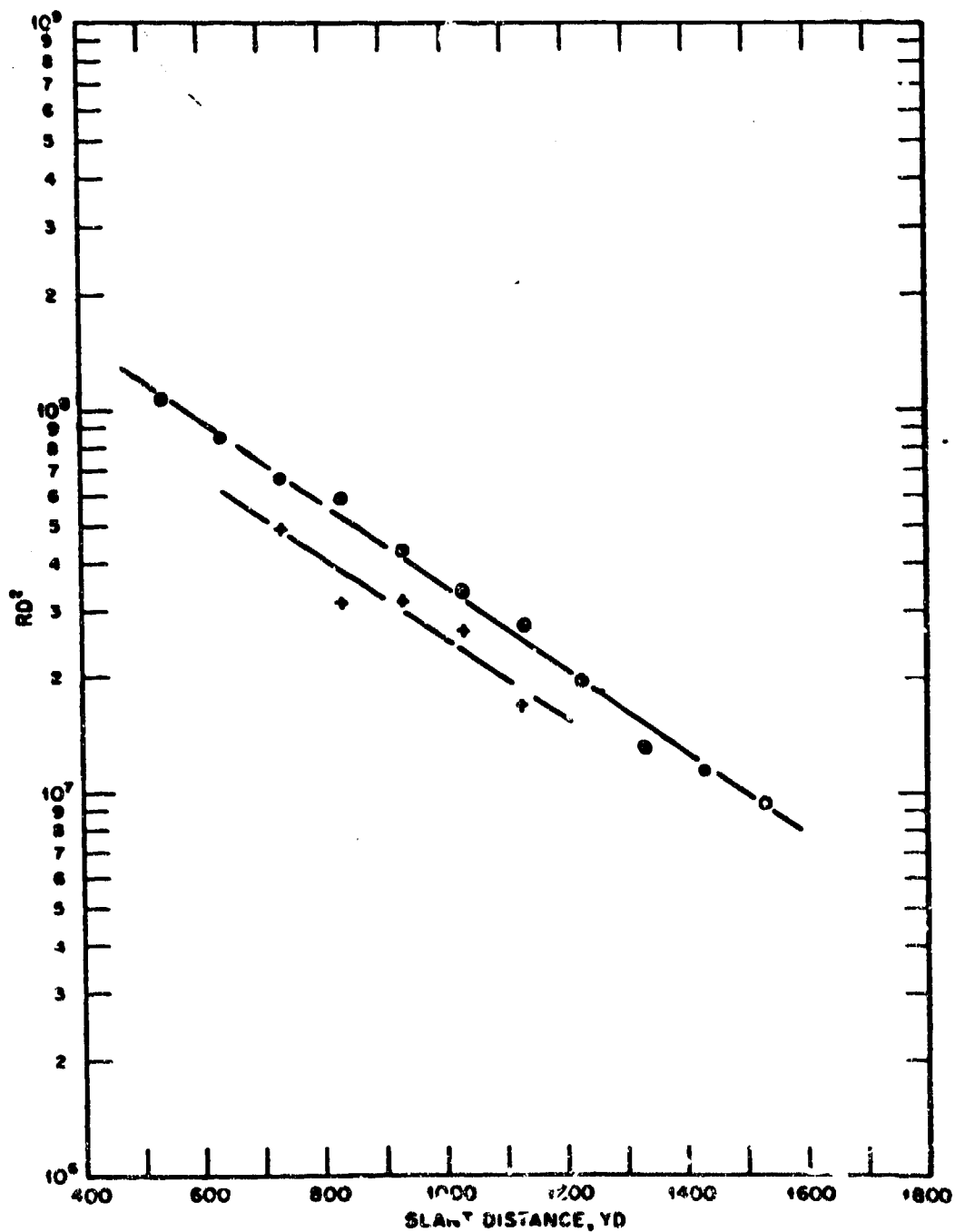


Fig. 3.2—Franklin, south line, RD^2 vs. D. O, make-line badges. +, goal-post badges.

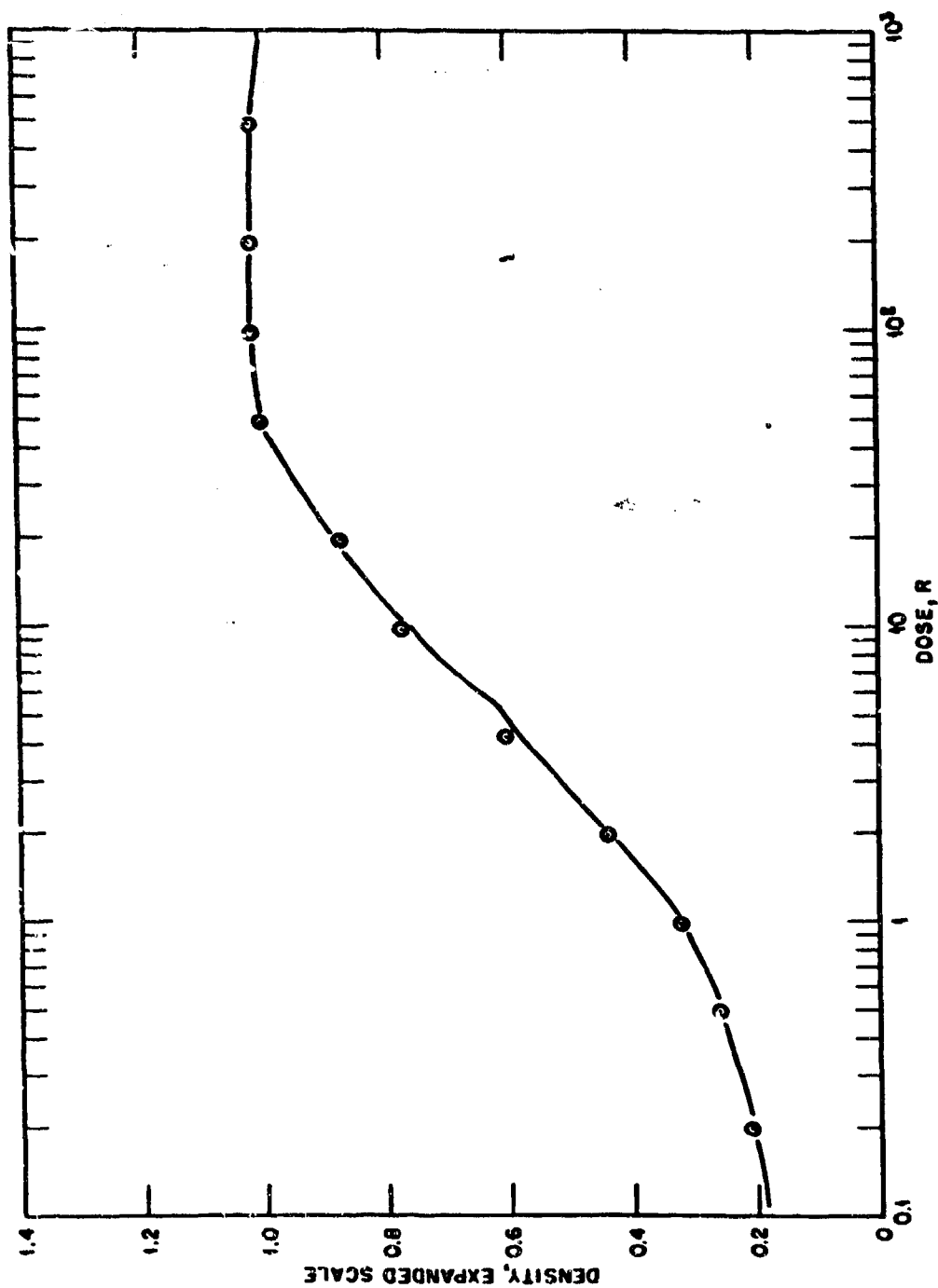


Fig. 3.3—Los Alamos gamma calibration, type 502 film.

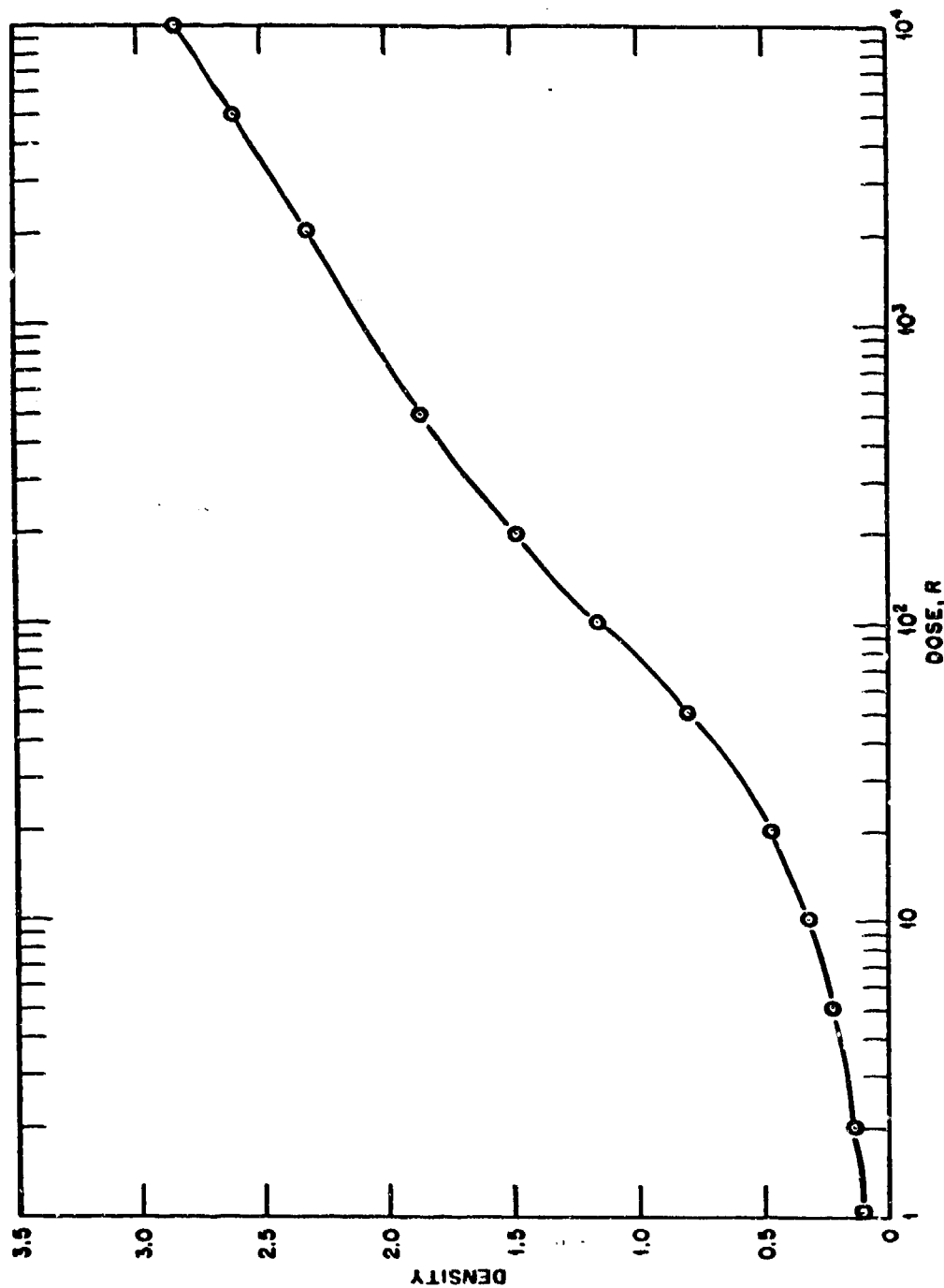


Fig. 3.4—Los Alamos gamma calibration, type 310 film.

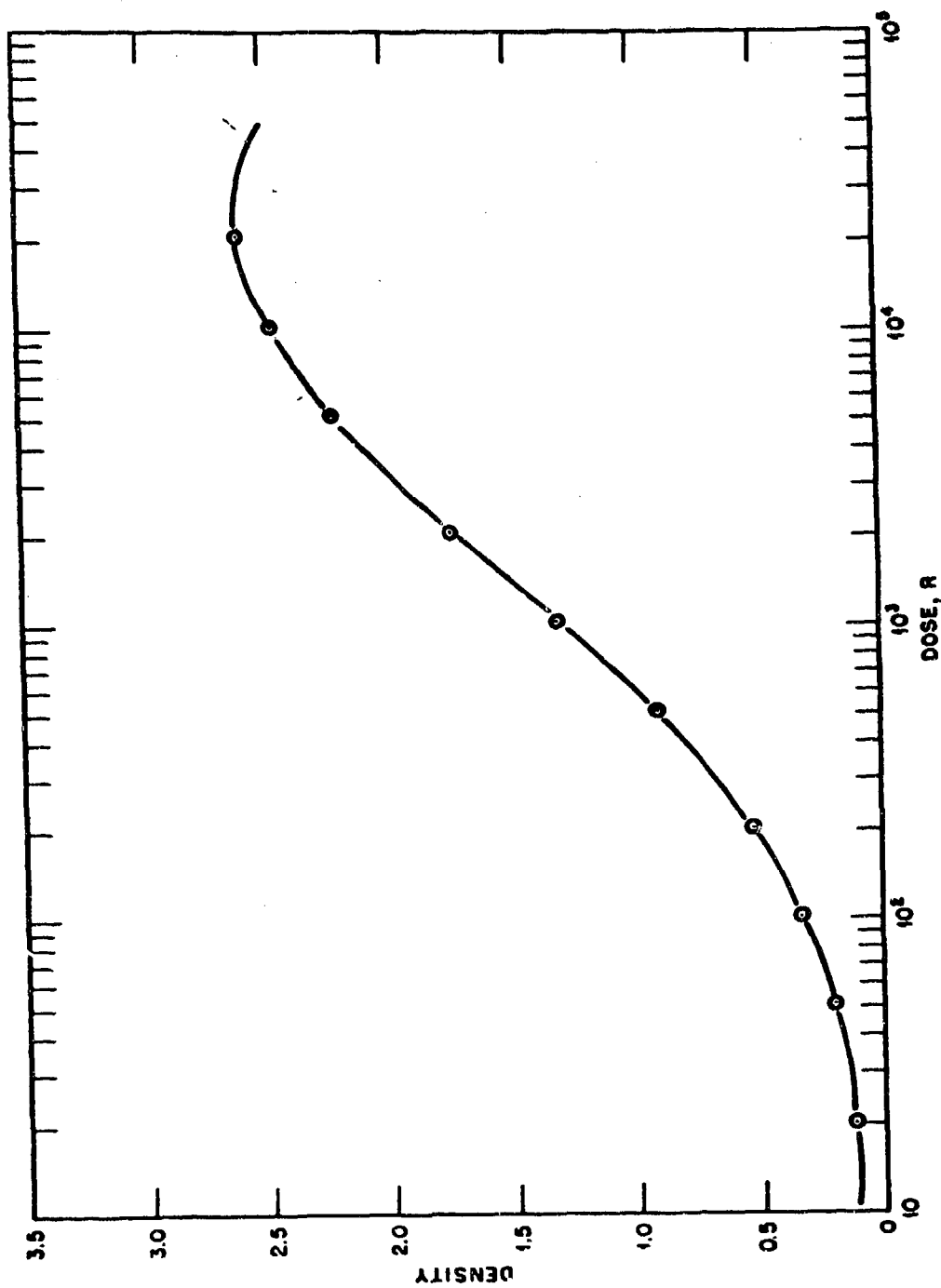


Fig. 3.5—Los Alamos gamma calibration, type 608 film.

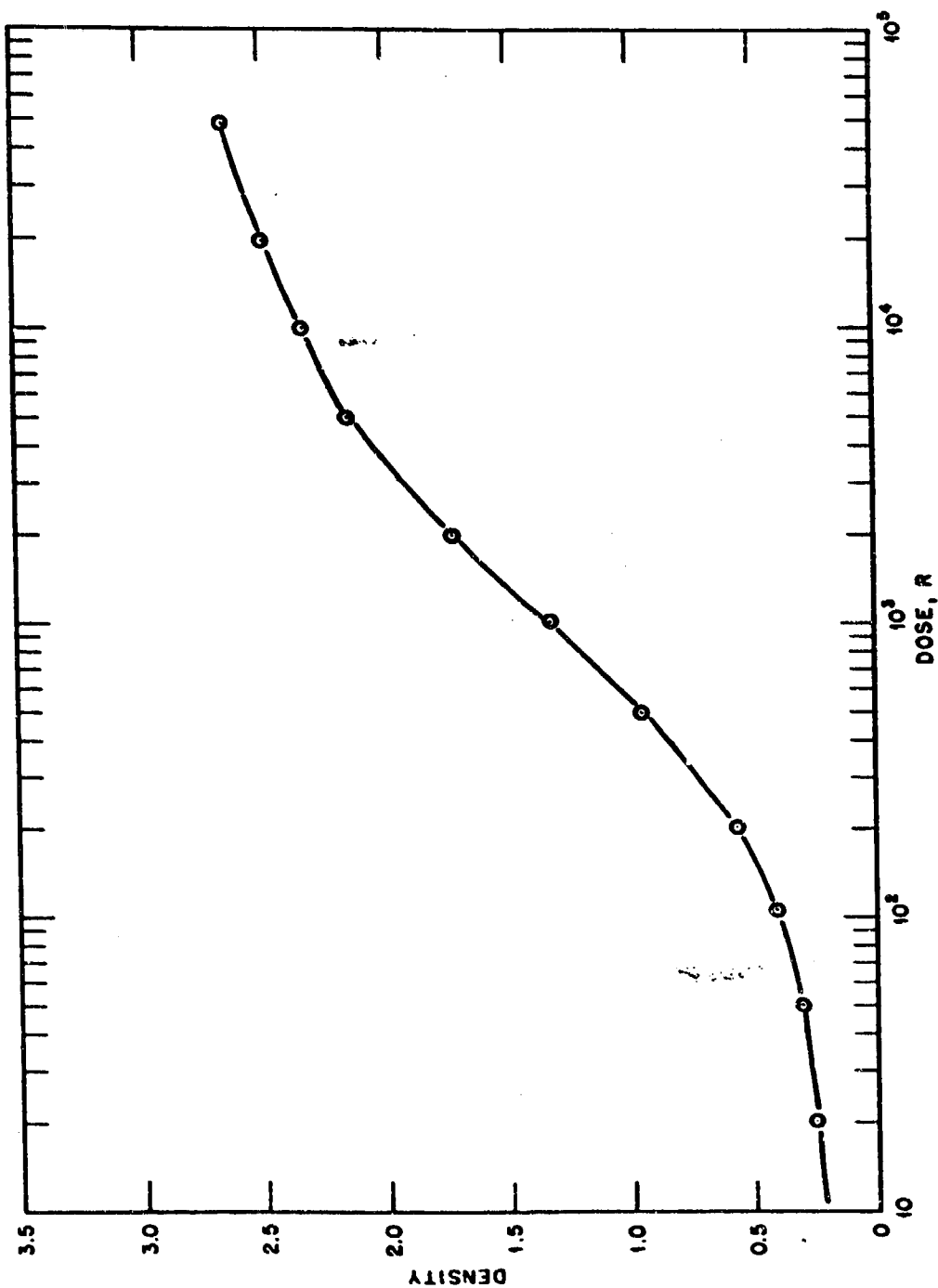


Fig. 3.6—Los Alamos gamma calibration, type SO-1112 film.

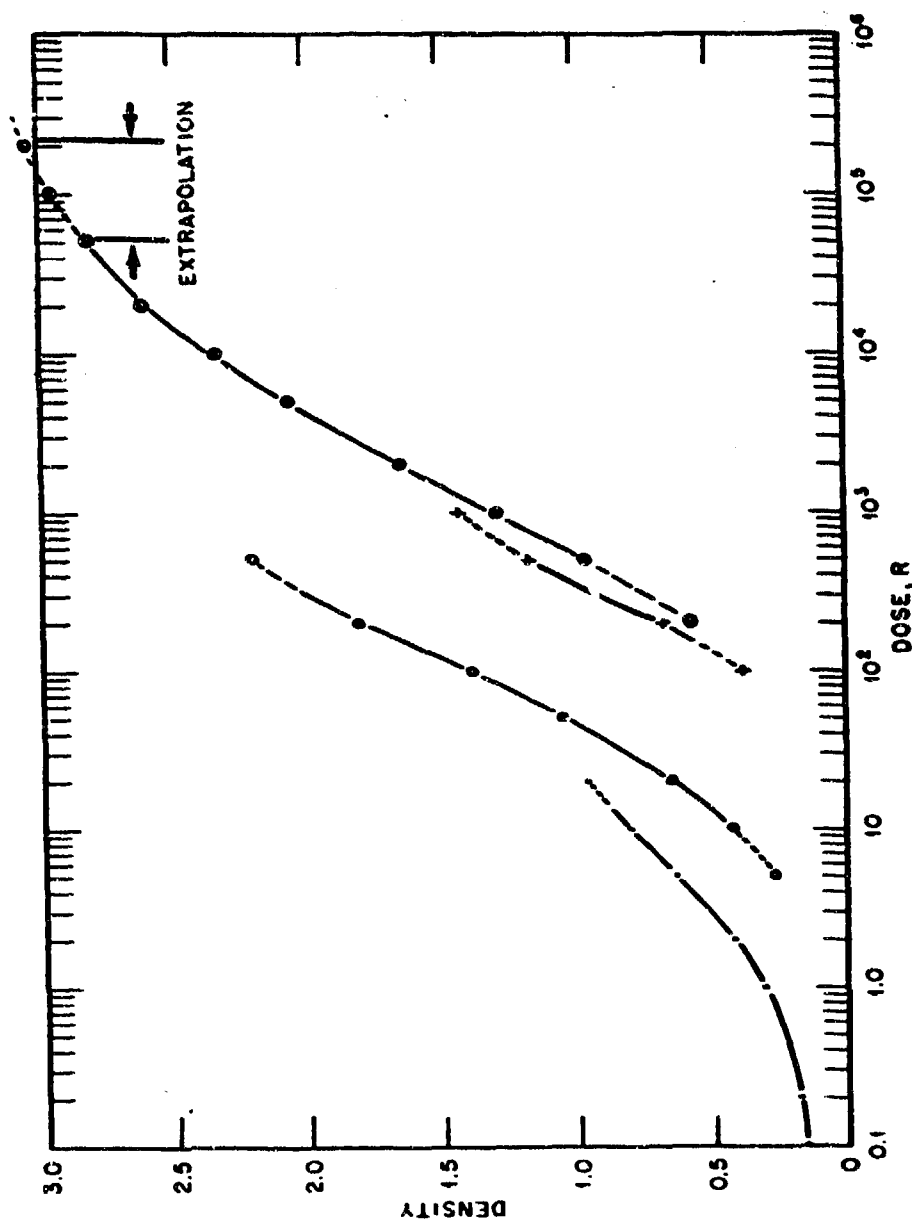


Fig. 3.7—ECGAG calibrations, useful portions of all films. n, 802, O, 610, x, 626, □, 1112.

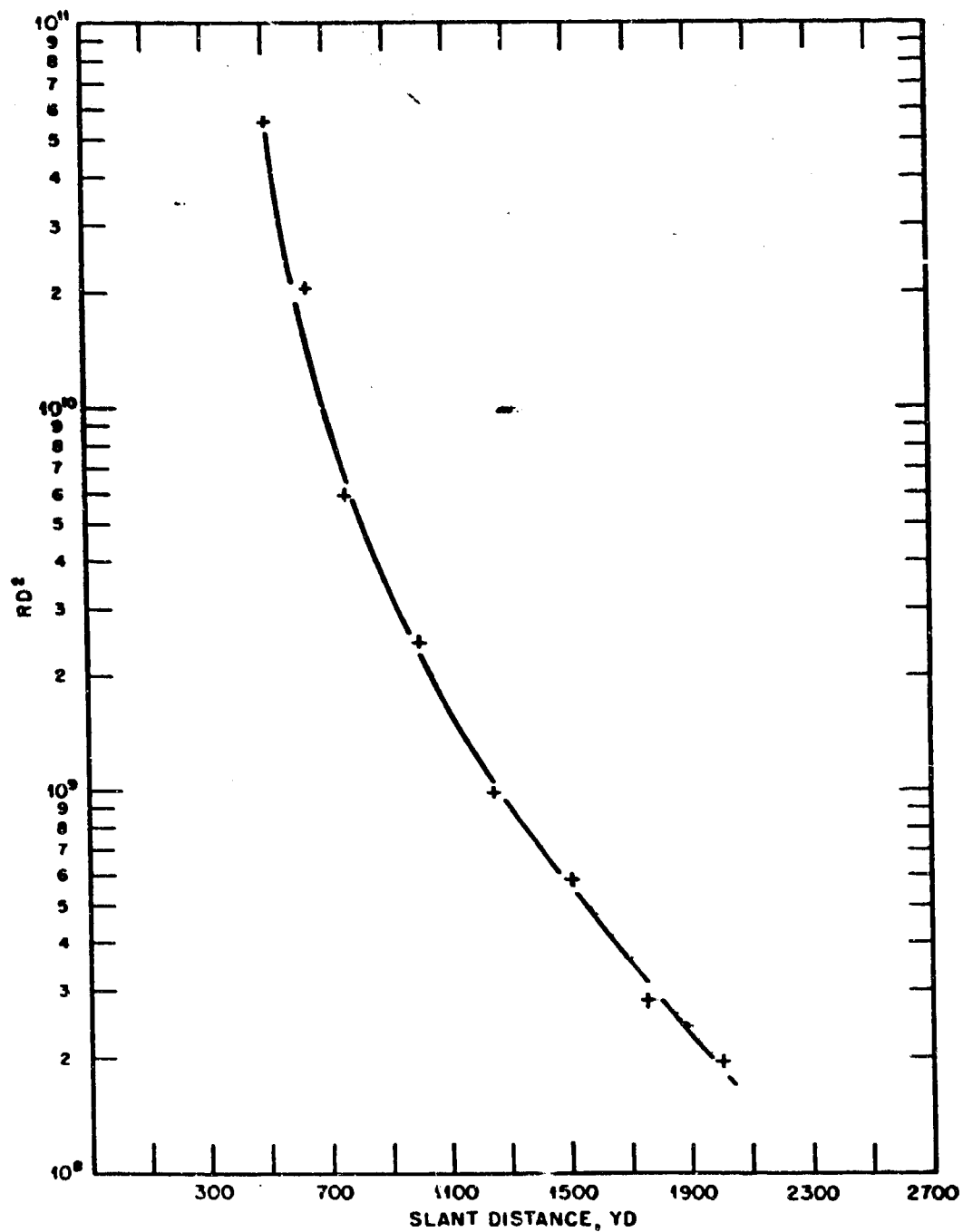


Fig. 3.8—Wilson, southeast goal-post line, RD^2 vs. D.

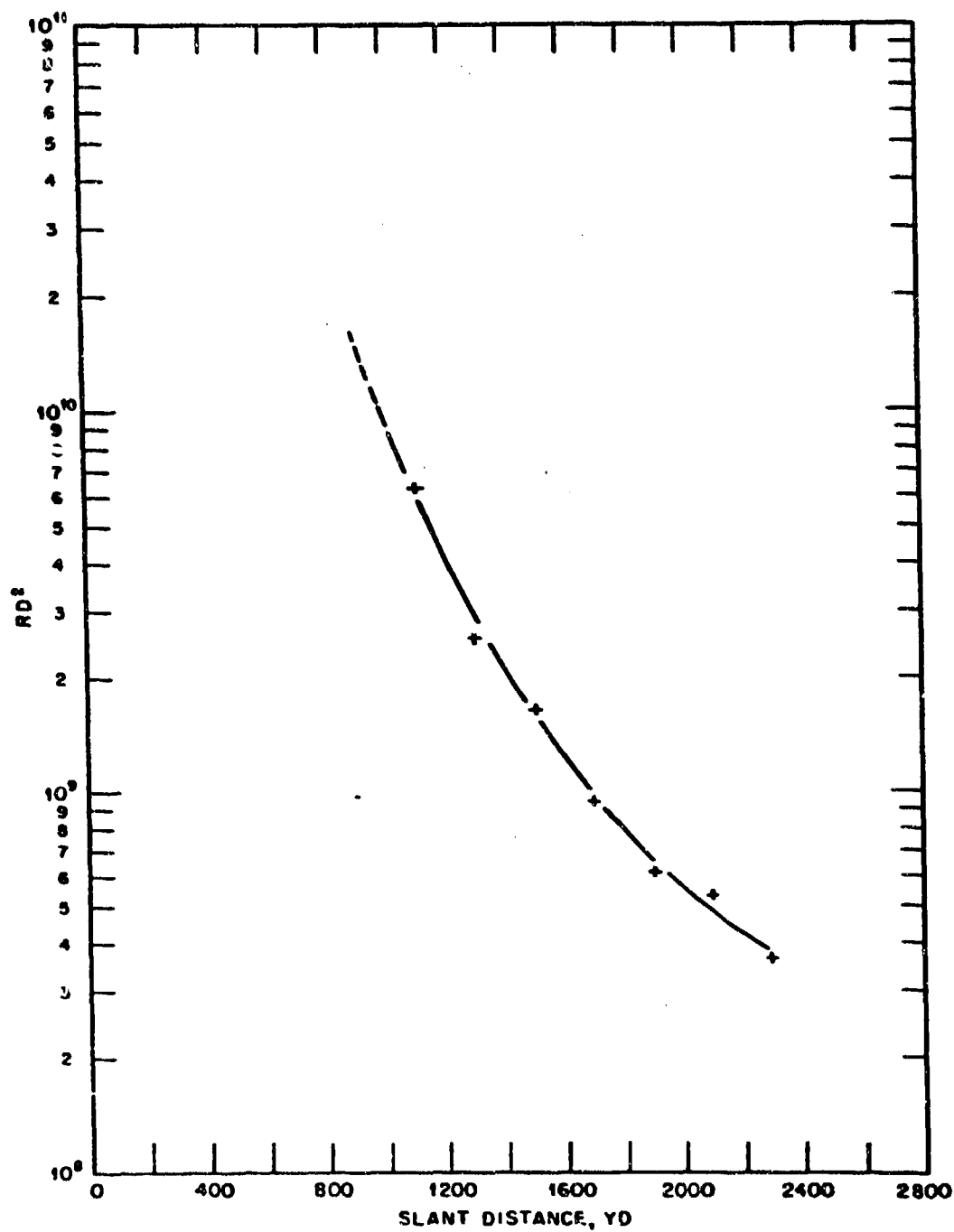


Fig. 3.9—Priscilla, stake line, RD^2 vs. D.

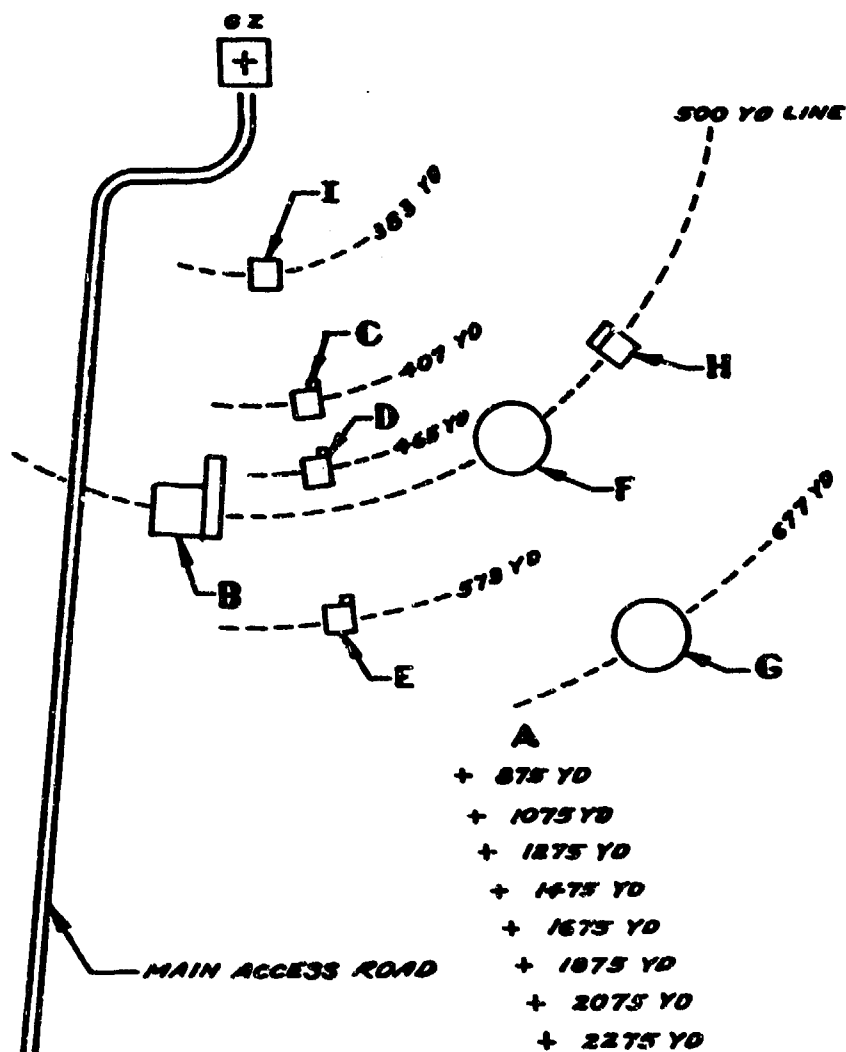


Fig. 3.10—Priscilla, film-badge locations.

- | | |
|--|--|
| A, stake line (Project 30.1) | E, family shelter No. 3 (Project 30.3) |
| B, underground garage (Project 30.2) | F, test dome No. 1 (Project 30.1) |
| C, family shelter No. 1 (Project 30.3) | G, test dome No. 3 (Project 30.1) |
| D, family shelter No. 2 (Project 30.3) | H, blast door (Project 30.1) |
| I, Mosler safe (Project 30.4) | |

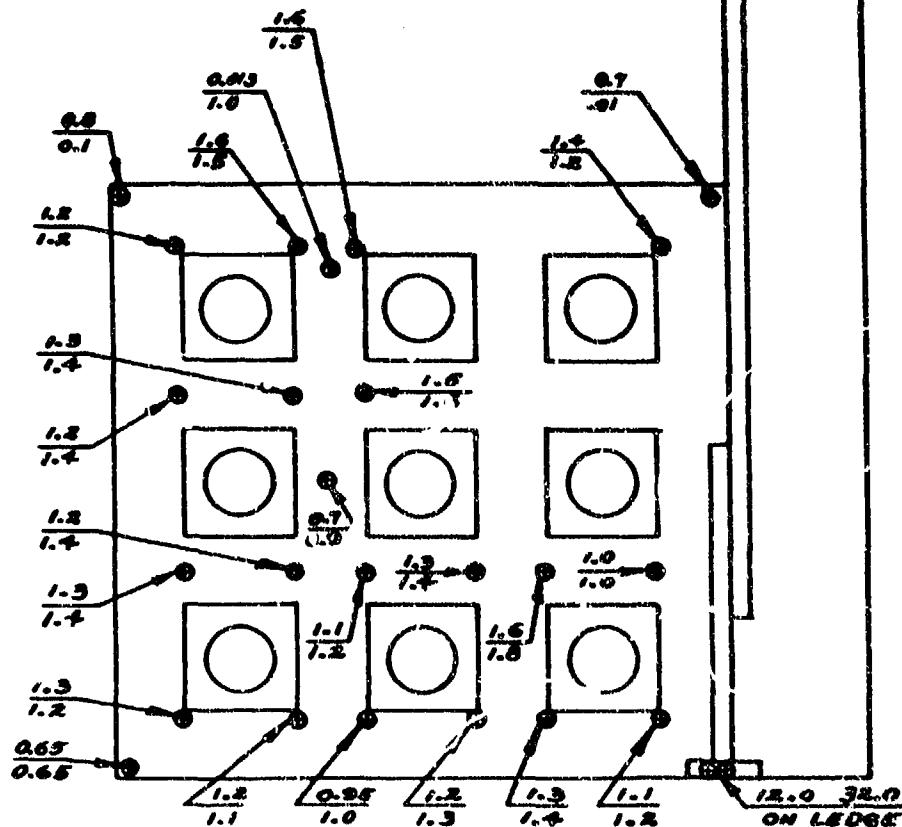


Fig. 3.11—Priscilla, underground garage (Project 30.2). ⊕, film badge locations at heights of 3 and 5 ft from the floor. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively.

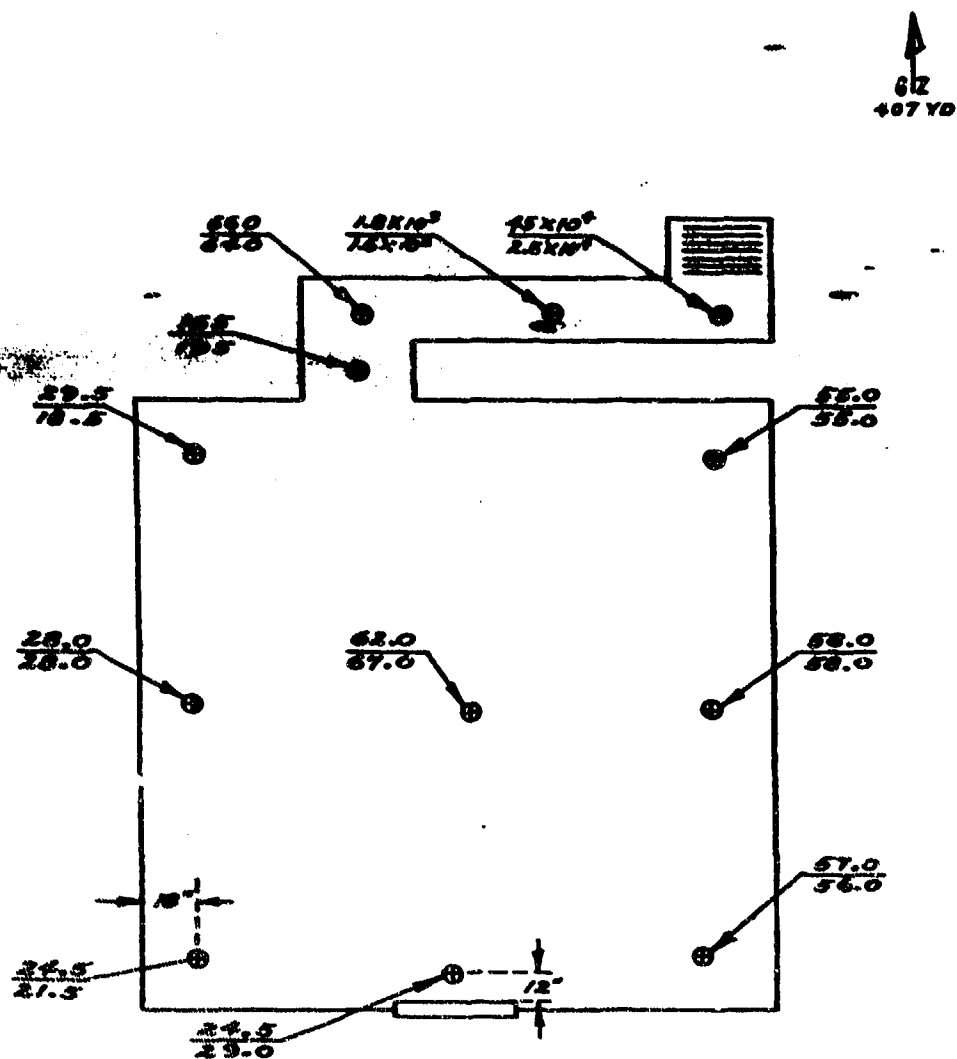


Fig. 3.12—Princilla, family shelter No. 1 (Project 30.3). ⊙, film-badge locations at heights of 3 and 5 ft from the floor. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively.

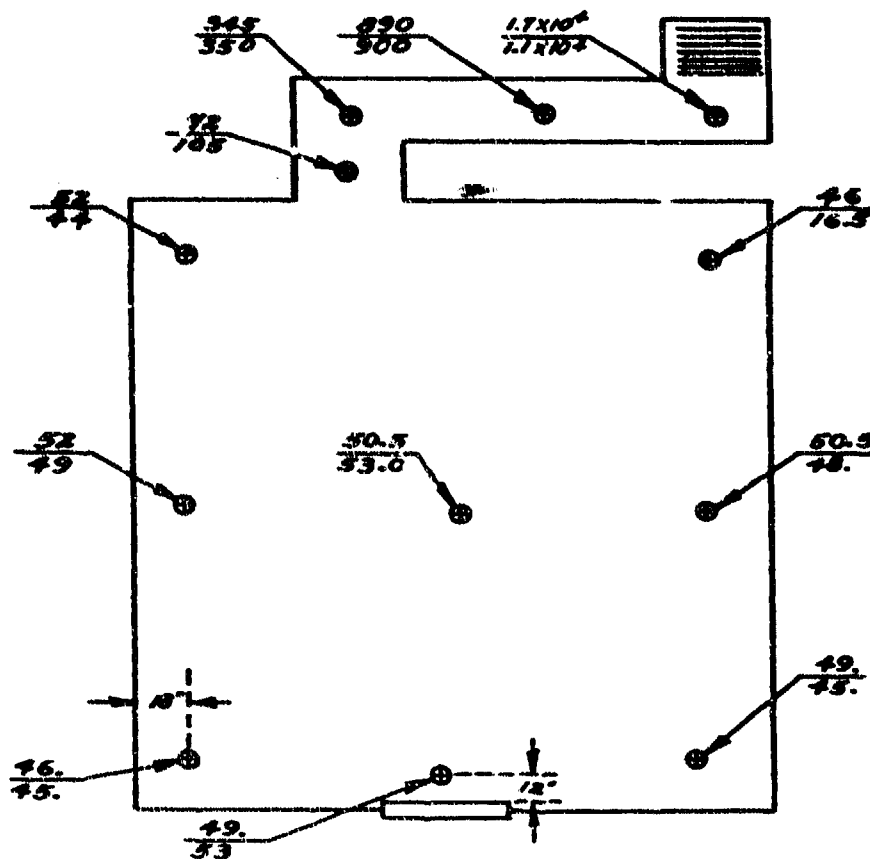


Fig. 5.13—Priscilla, family shelter No. 2 (Project 30.3). ⊙, film-badge locations at heights of 3 and 5 ft from the floor. The readings above and below the lines are the distances to rooms at the 5- and 3-4x heights, respectively.

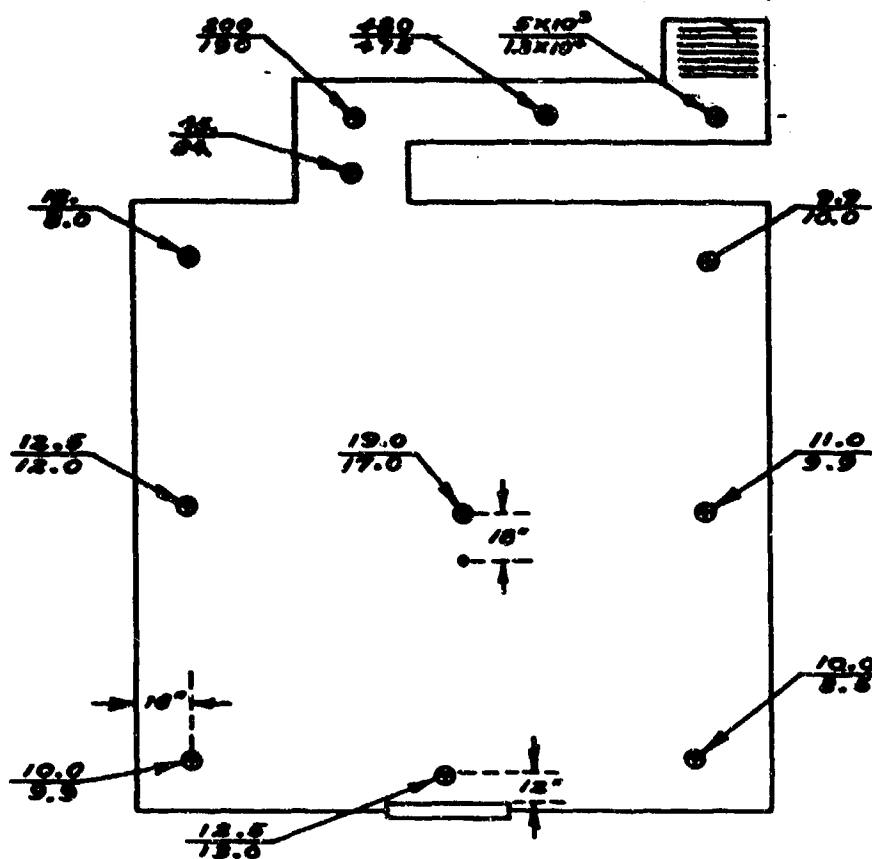


Fig. 3.14—Priscilla, family shelter No. 3 (Project 30.3). @, film-badge locations at heights of 3 and 5 ft from the floor. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively.

612
300 YD

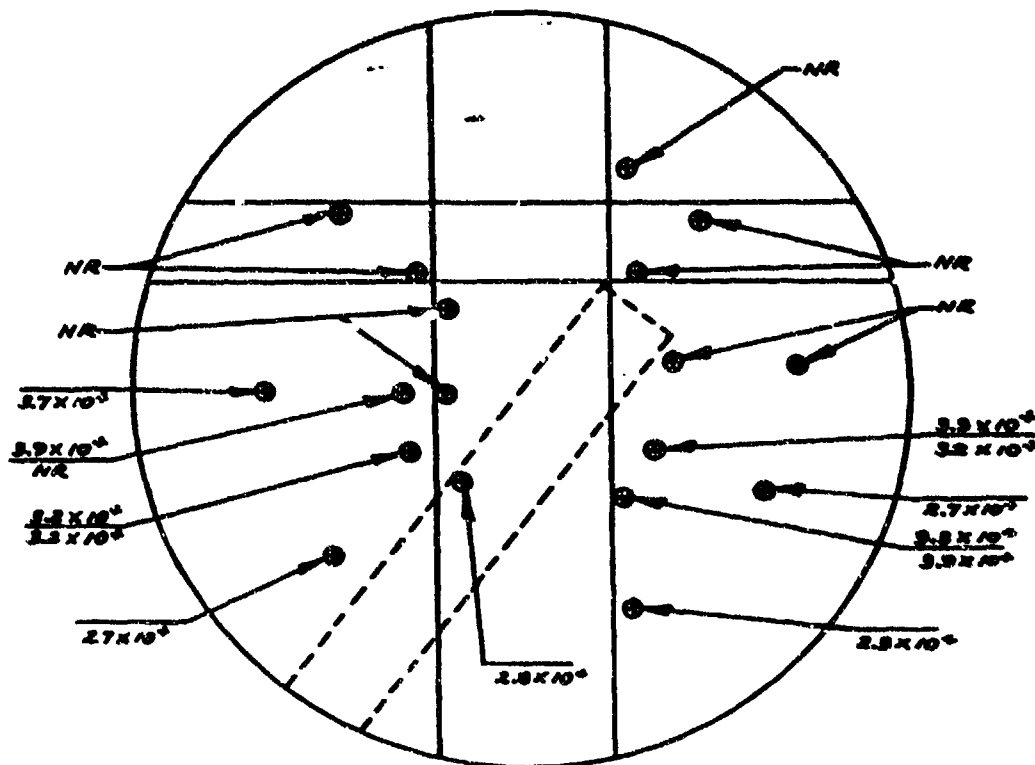


Fig. 3.15—Priscilla, test dome No. 1 (Project 30.1). ⊙, film-badge locations at heights of 3 and 5 ft from the floor. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively. NR: not recovered.

612
67710

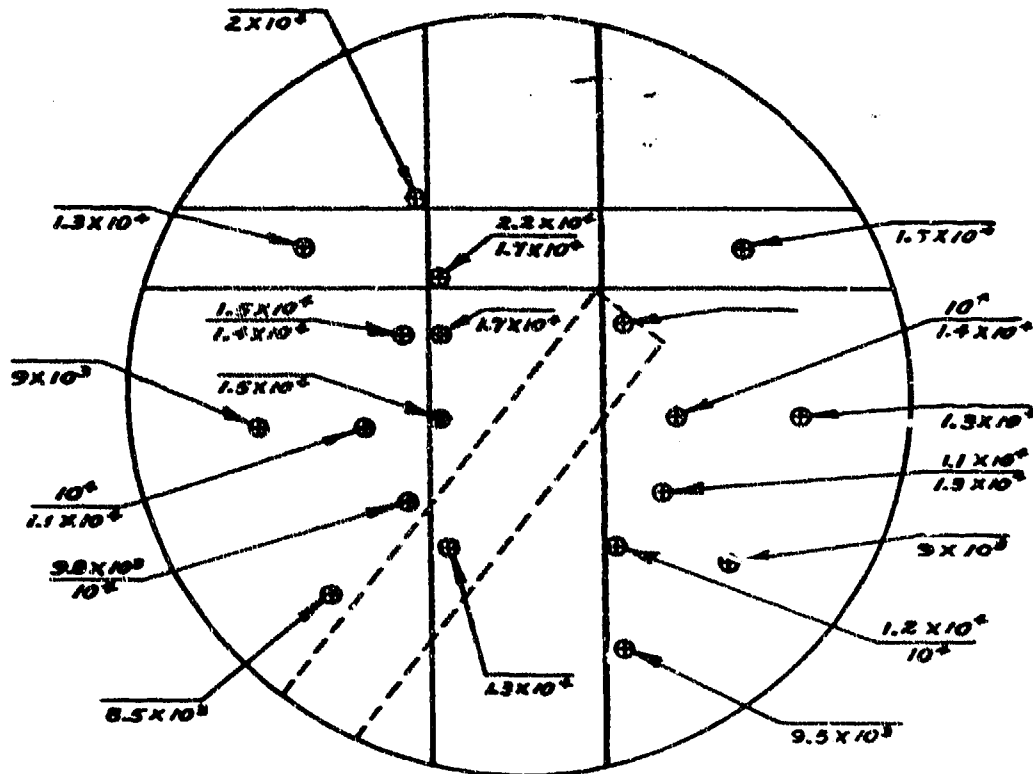


Fig. 3.16—Pracilla, test dome No. 3 (Project 30.1). ⊗. (Bla-badger locations at heights of 3 and 5 ft from the floor. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively.

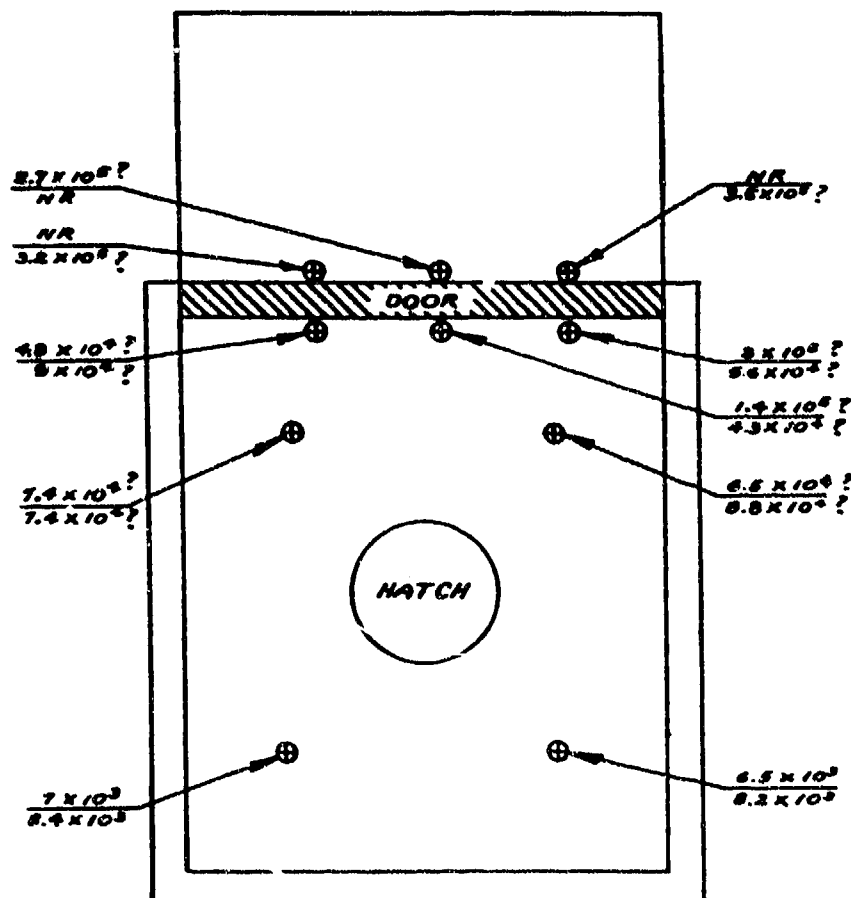


Fig. 3.17—Priscilla, blast door (Project 30.1). ⊕, film-badge locations at heights of 3 and 5 ft from the floor. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively. NR: not recovered.

612
383 YARDS

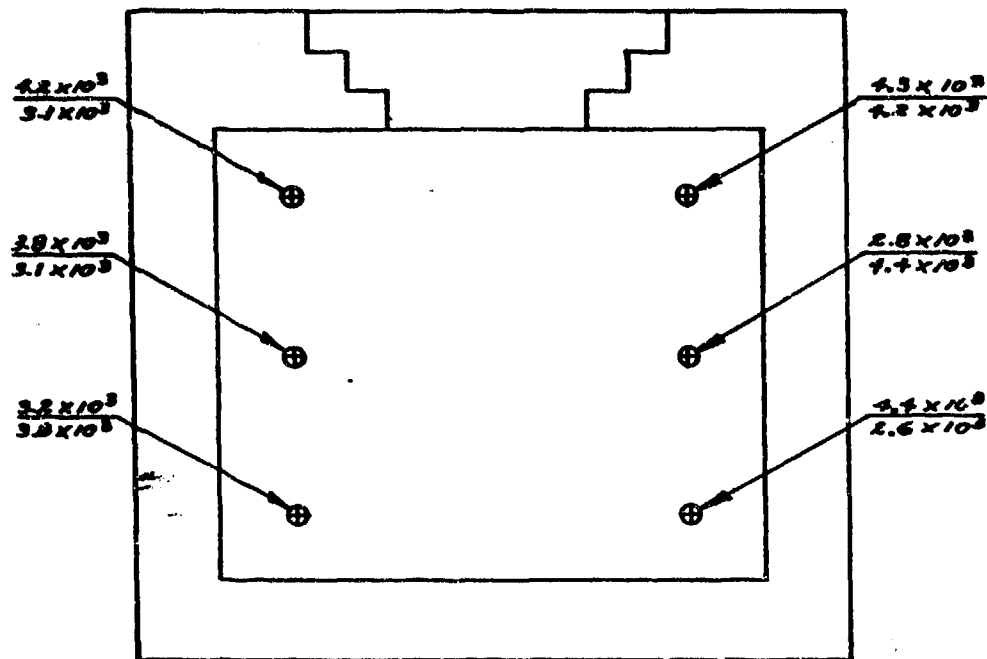


Fig. 3.18—Priscilla, Mosler vault (Project 30.4). ⊕, film-badge locations at heights of 3 and 5 ft from the floor. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively.

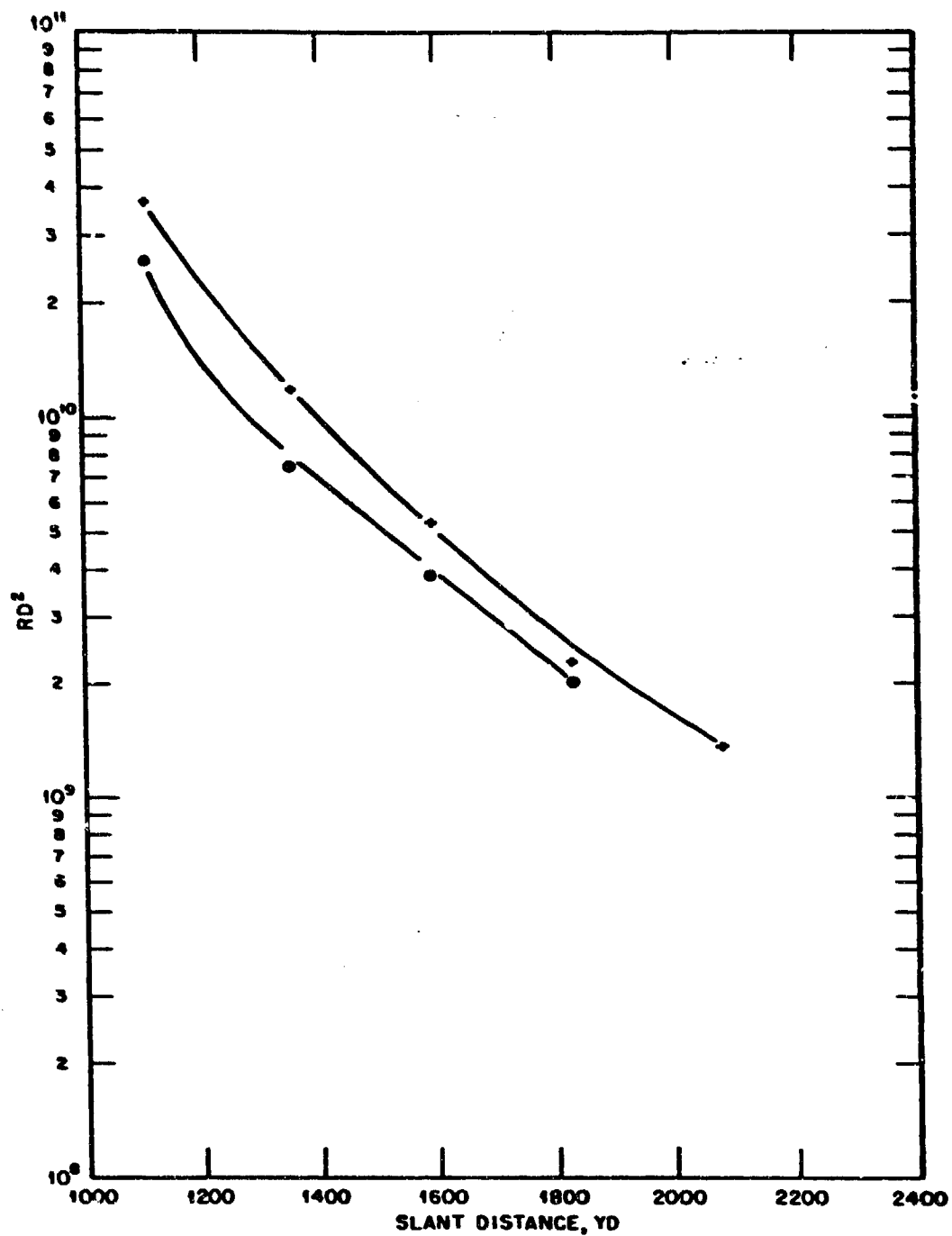


Fig. 3.19—Horizontal goal-post line, RD^2 vs. D. +, EG&G film badges. O, film in lithium can.

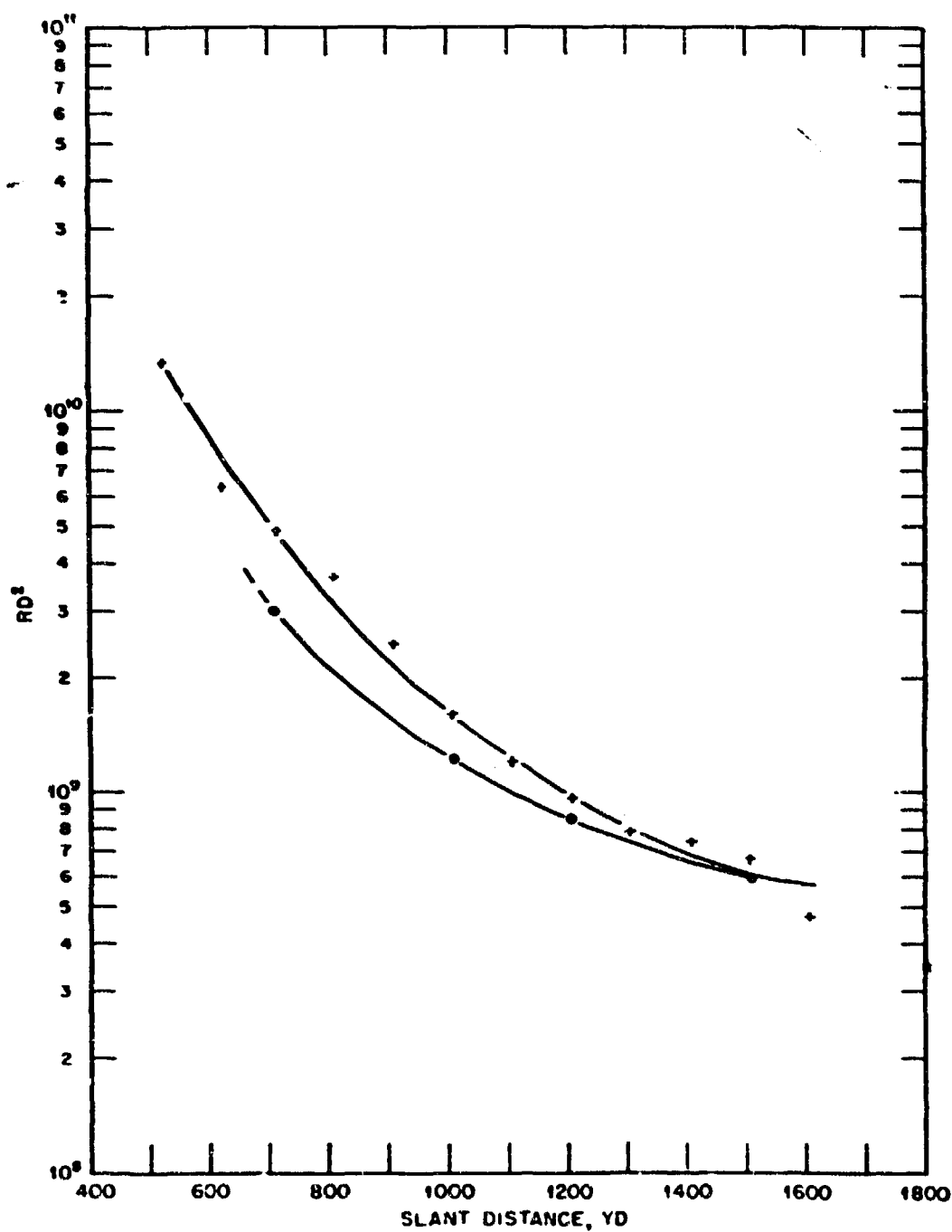


Fig. 3.20—Diablo, north goal-post line, RD^2 vs. D. +, EG&G film badges. o, film in lithium can.

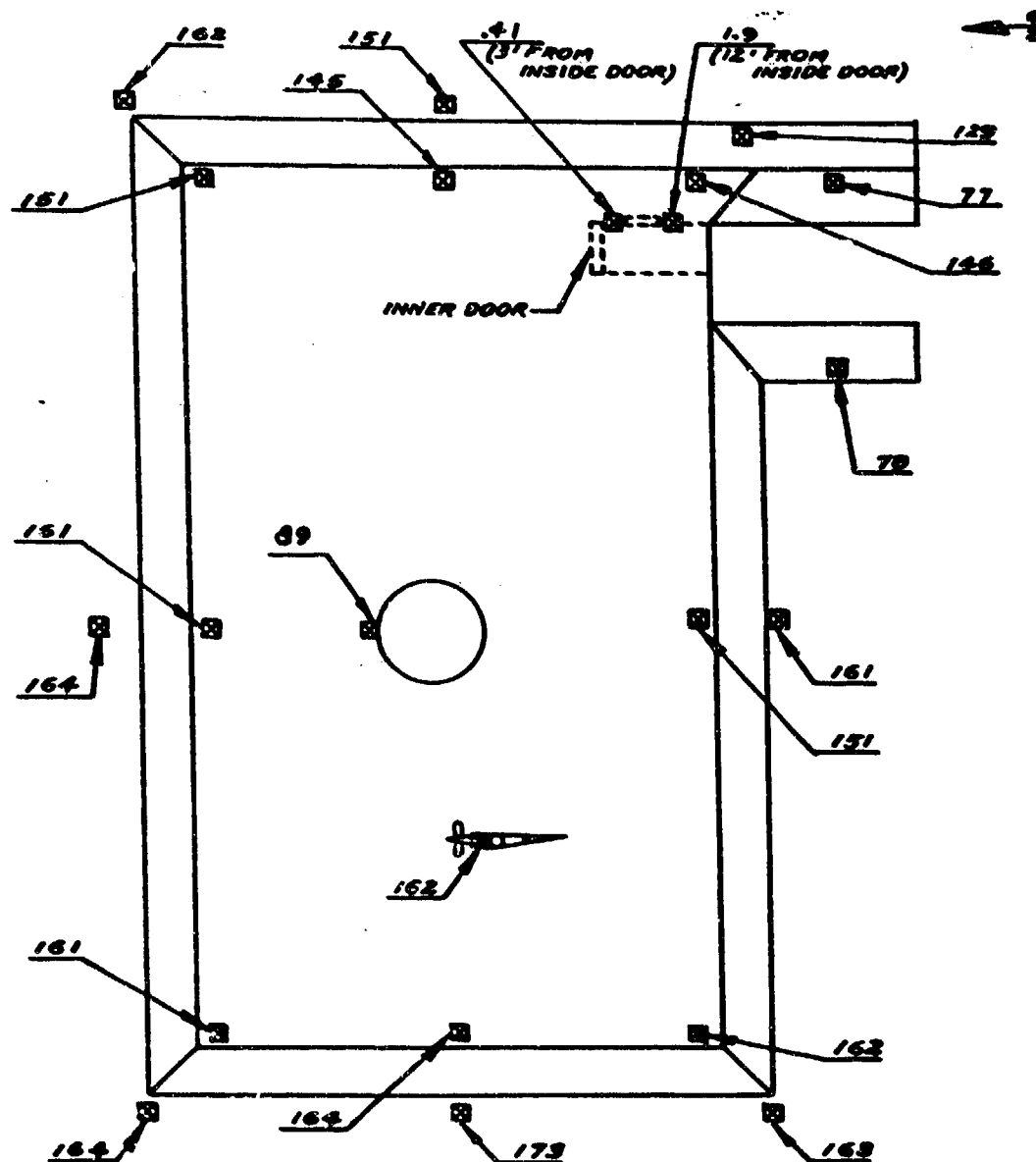
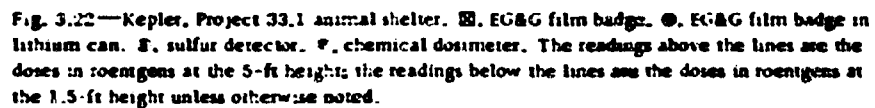


Fig. 3.21—Diablo, Project 32.3 manned shelter. 89, two EGBG badges at a height of 3 ft. Average size of the two is given in parentheses. Badges at two positions near the inner door are placed inside the entranceway of the shelter. All readings are for external doors.



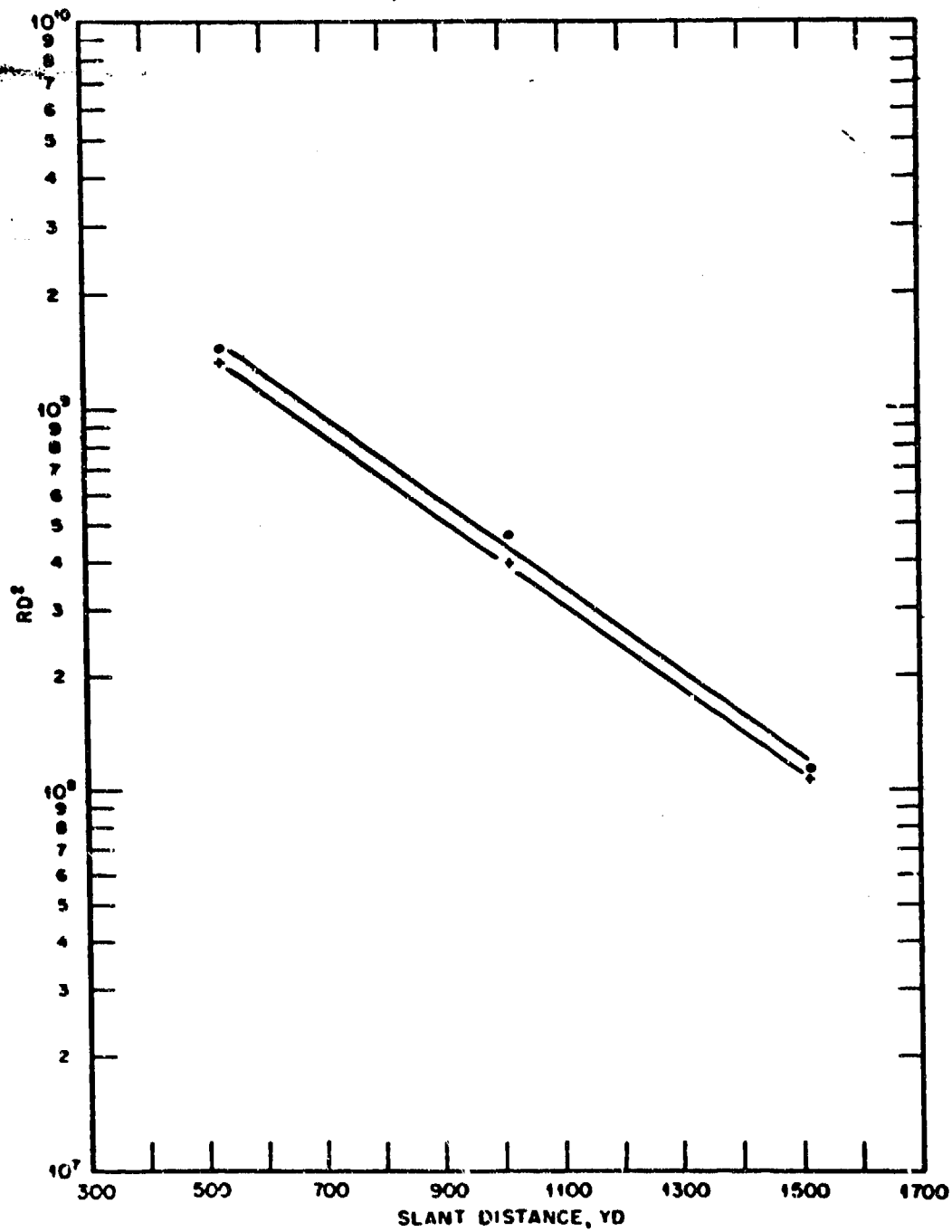


Fig. 3.23 -- Kepler, north goal-post line, RD^2 vs. D . +, EG&G film badges. O, film in lithium can.

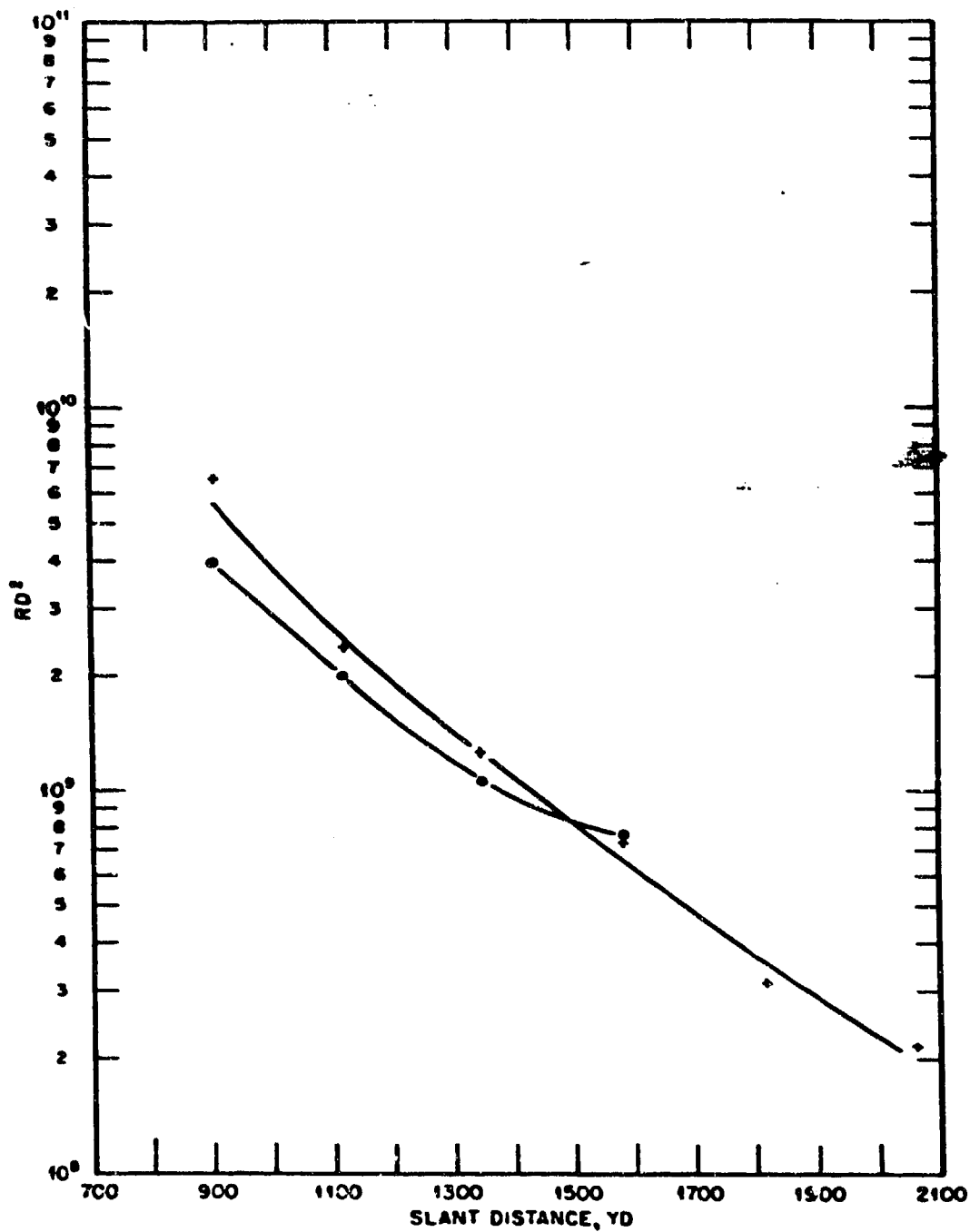


Fig. 3.24—Stokes, goal-post line, RD^2 vs. D . +, EG&G film badges. O, film in lithium can.

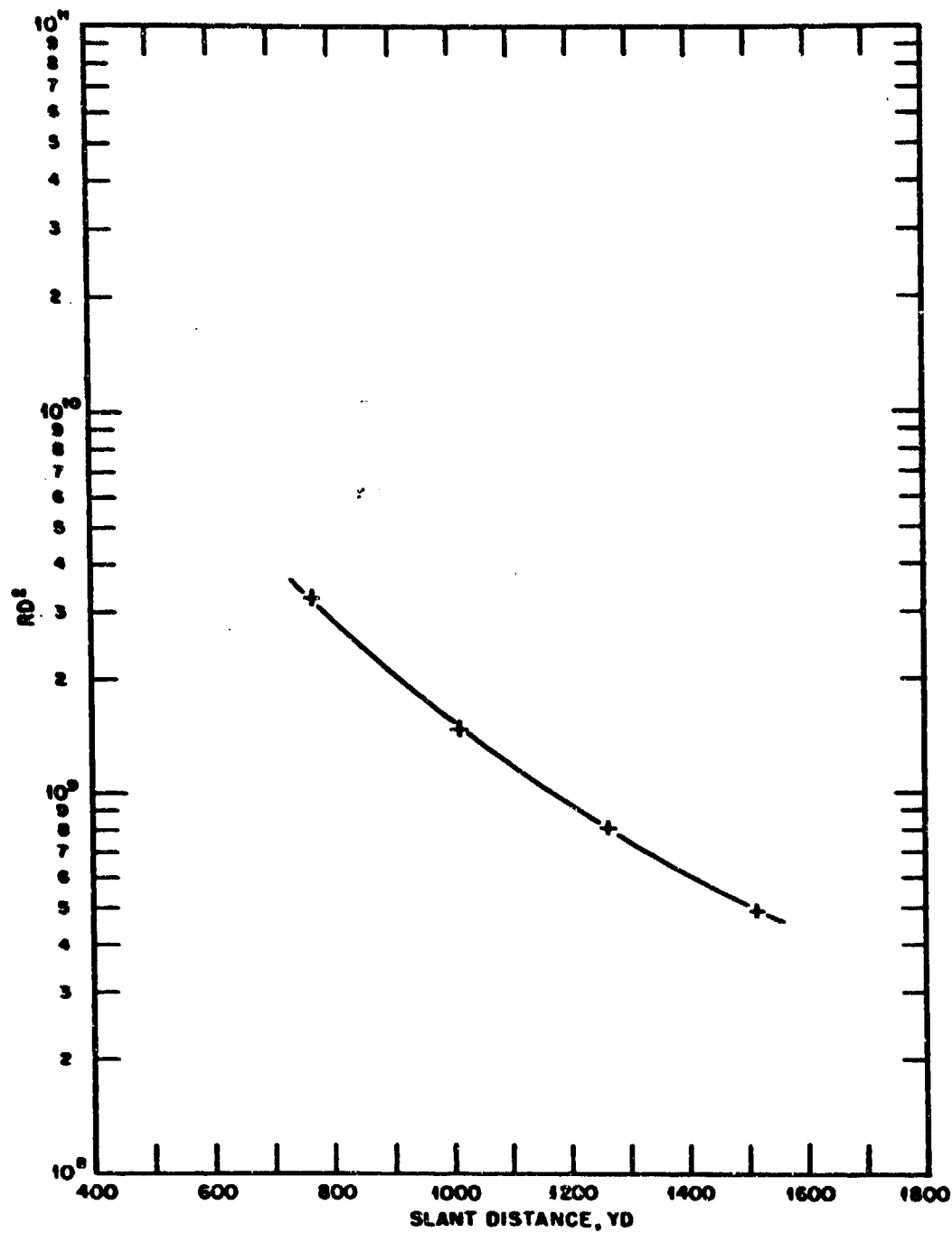


Fig. 3.25—Shasta, north goal-post line, RD^2 vs. D .

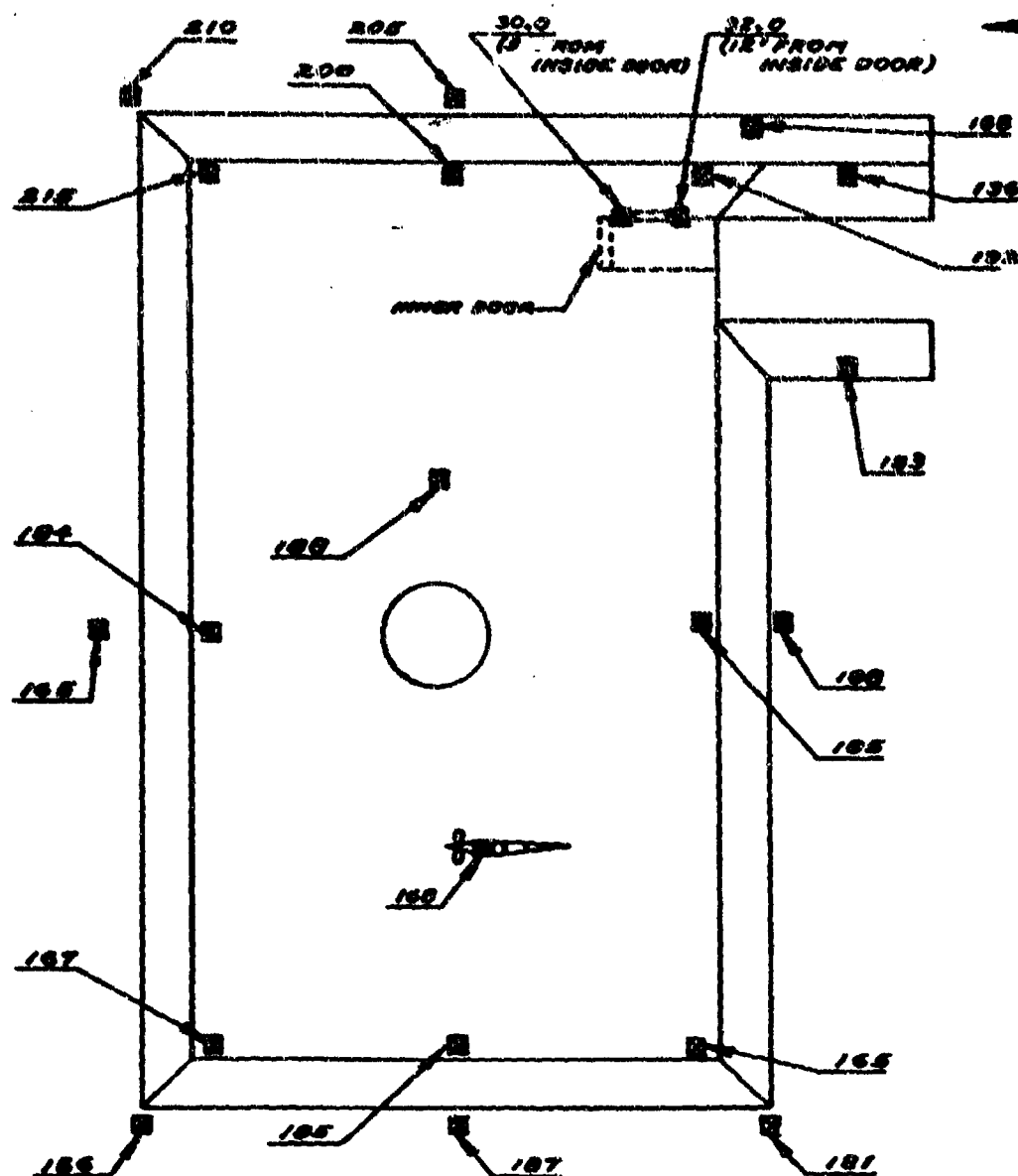


Fig. 3.26—Shasta, Project 32.3 manned shelter. The external door is indicated in romanians.

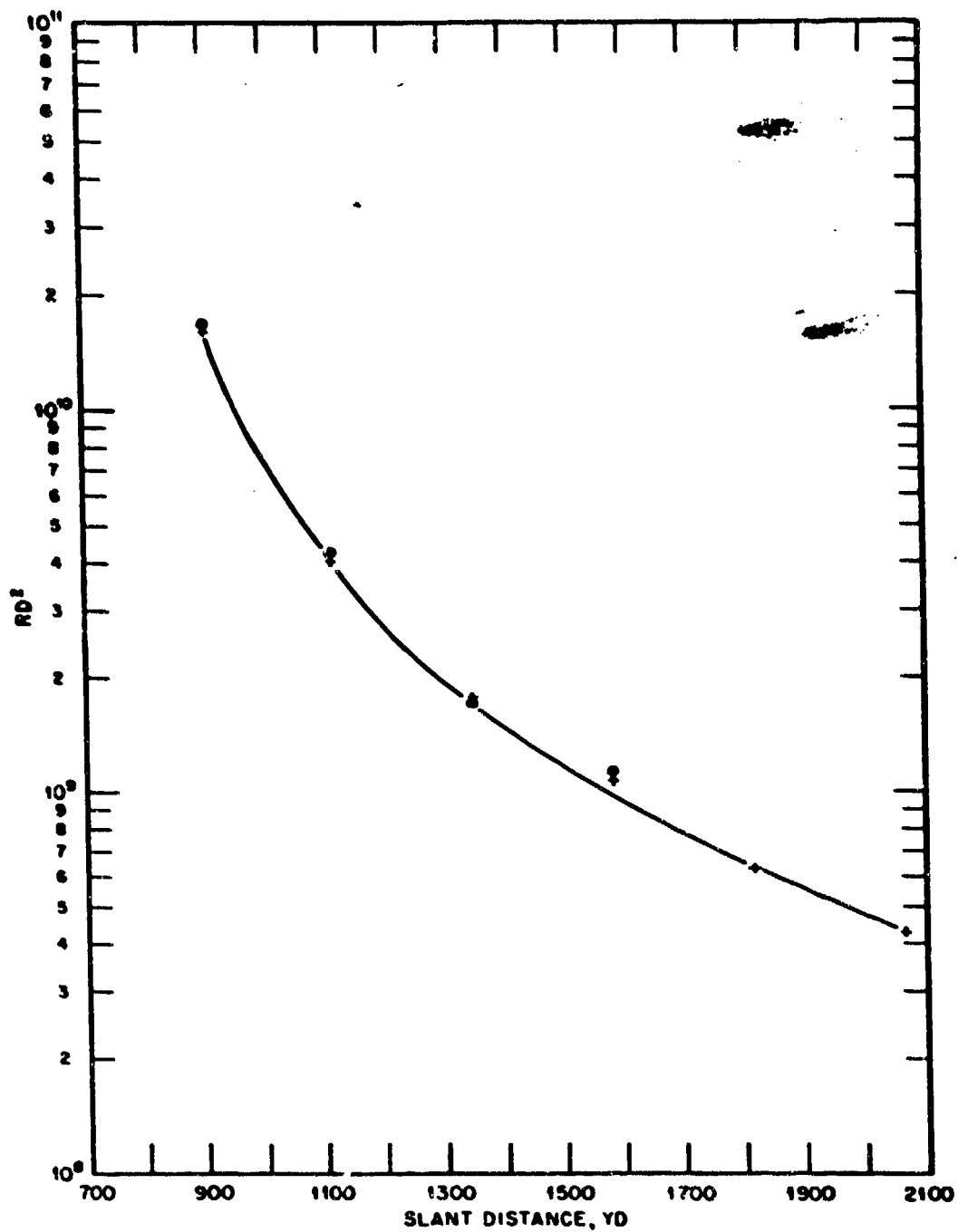


Fig. 3.27—Doppler, goal-post line, RD^2 vs. D. +, EG&G film badges, O, film in lithium can.

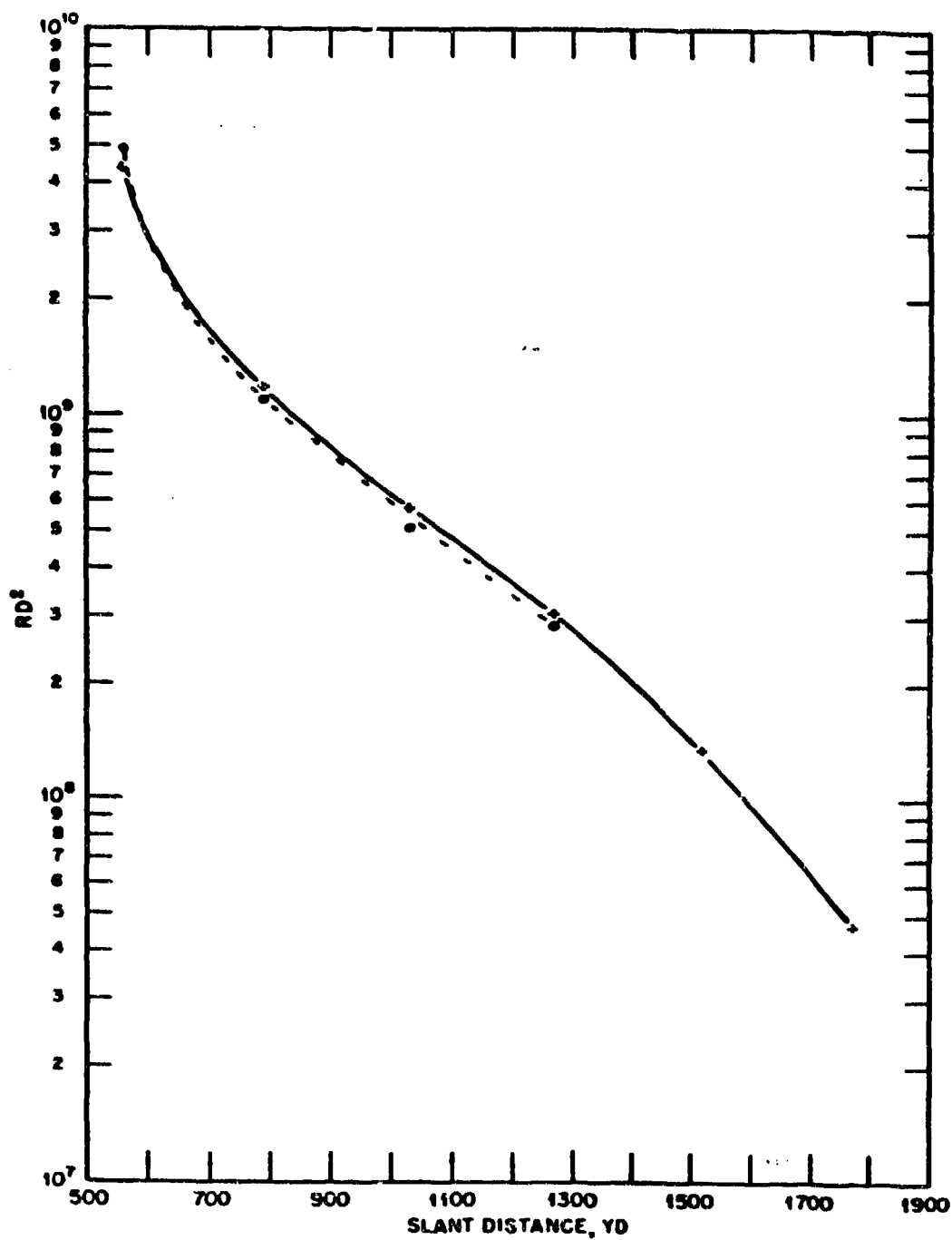
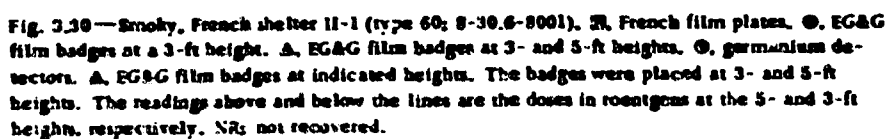


Fig. 3.28—Franklin Prime, goal-post line, RD^2 vs. D. +, EG&G film badges. O, film in lithium can.



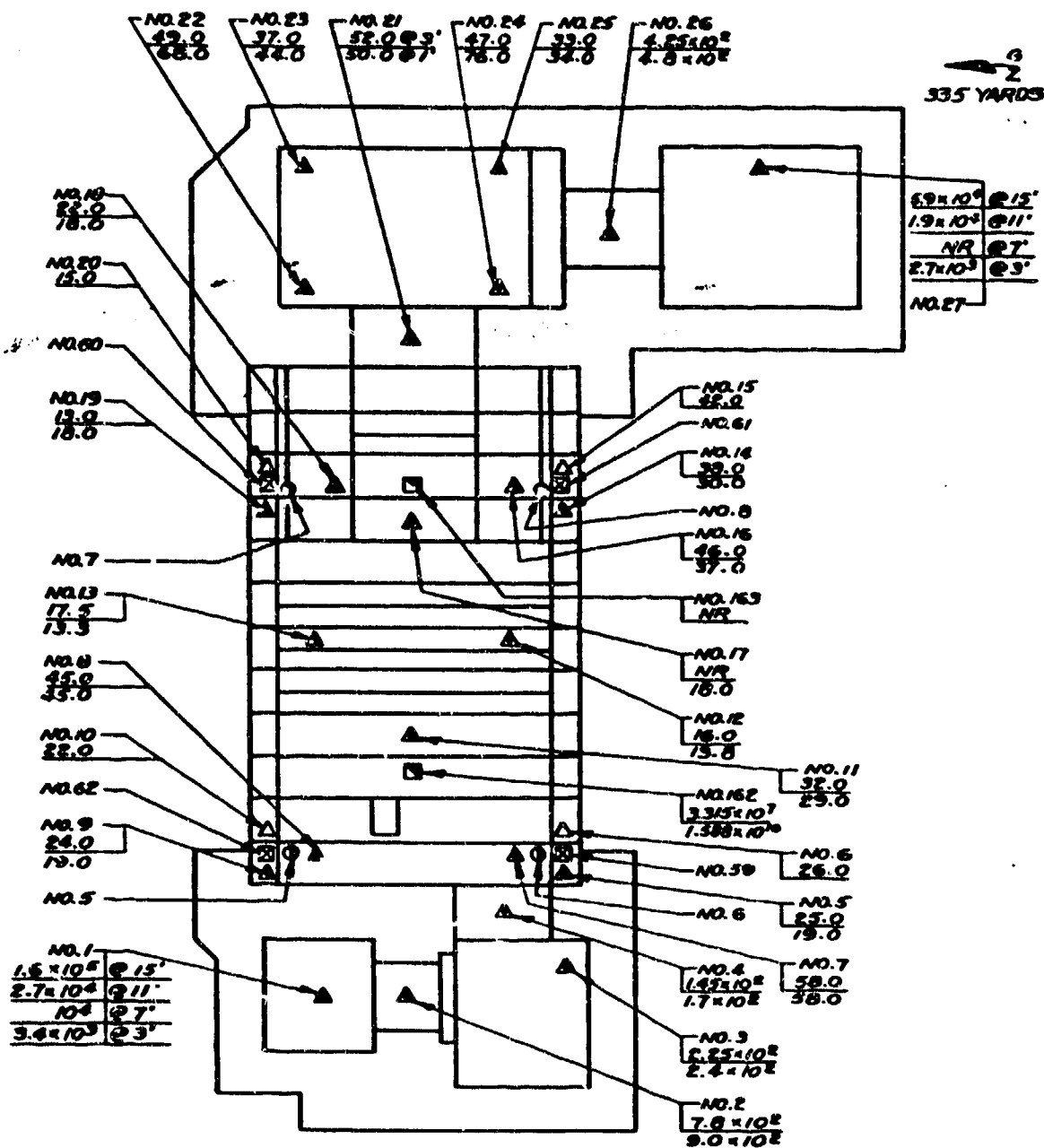
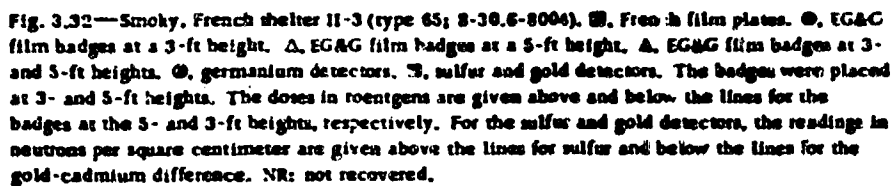


Fig. 3.31—Smoky, French shelter II-2 (type 50; 8-30.6-8002). ■, French film plates. Δ, EG&G film badges at a 5-ft height. ▲, EG&G film badges at 3- and 5-ft heights. ○, germanium detectors. ⊞, sulfur and gold detectors. ⊙, EG&G film badges at indicated heights. The badges were placed at 3- and 5-ft heights. The doses in roentgens are given above and below the lines for the badges at the 5- and 3-ft heights, respectively. For the sulfur and gold detectors, the readings in neutrons per square centimeter are given above the lines for sulfur and below the lines for the gold-cadmium difference. NR: not recovered.



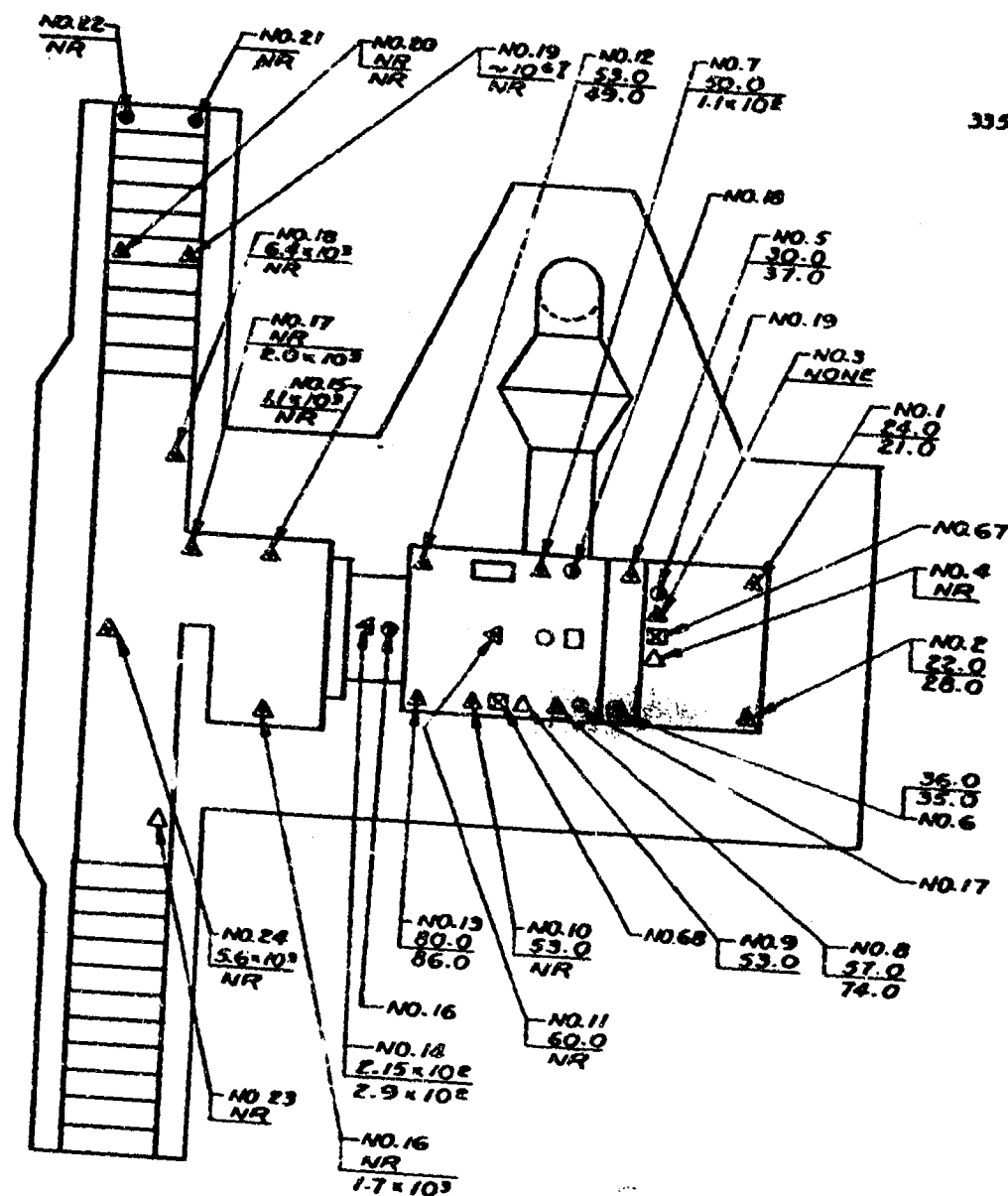


Fig. 3.33—Smoky, French shelter II-4 (type 85; 9-30.6-8005). \square , French film plates. Δ , EG&G film badges at a 5-ft height. \circ , EG&G film badges at a 3-ft height. \square , French film plates. Δ , EG&G film badges at 3- and 5-ft heights. ∇ , EG&G film badges at indicated heights. \circ , EG&G film badges at 3- and 5-ft heights. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively. NR: not recovered.


 250 YARDS

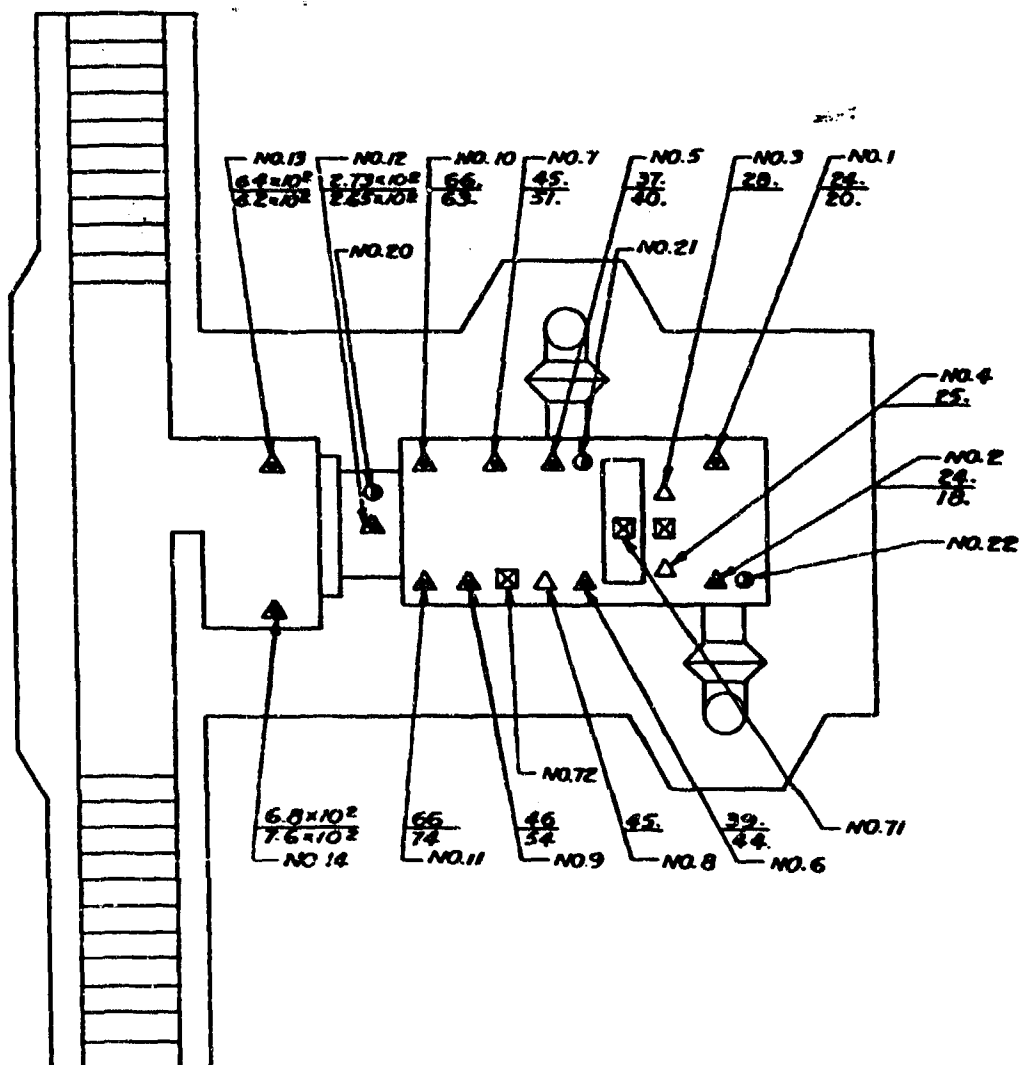


Fig. 3.34—Smoky. French shelter II 5 (type 65; 8-30.6-8003). ●, French film planes. ○, EG&G film badges at a 3-ft height. Δ, EG&G film badges at a 5-ft height. ▲, EG&G film badges at 3- and 5-ft heights. ⊠, germanium detectors. The badges were placed at 3- and 5-ft heights. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively. NR: not recovered.

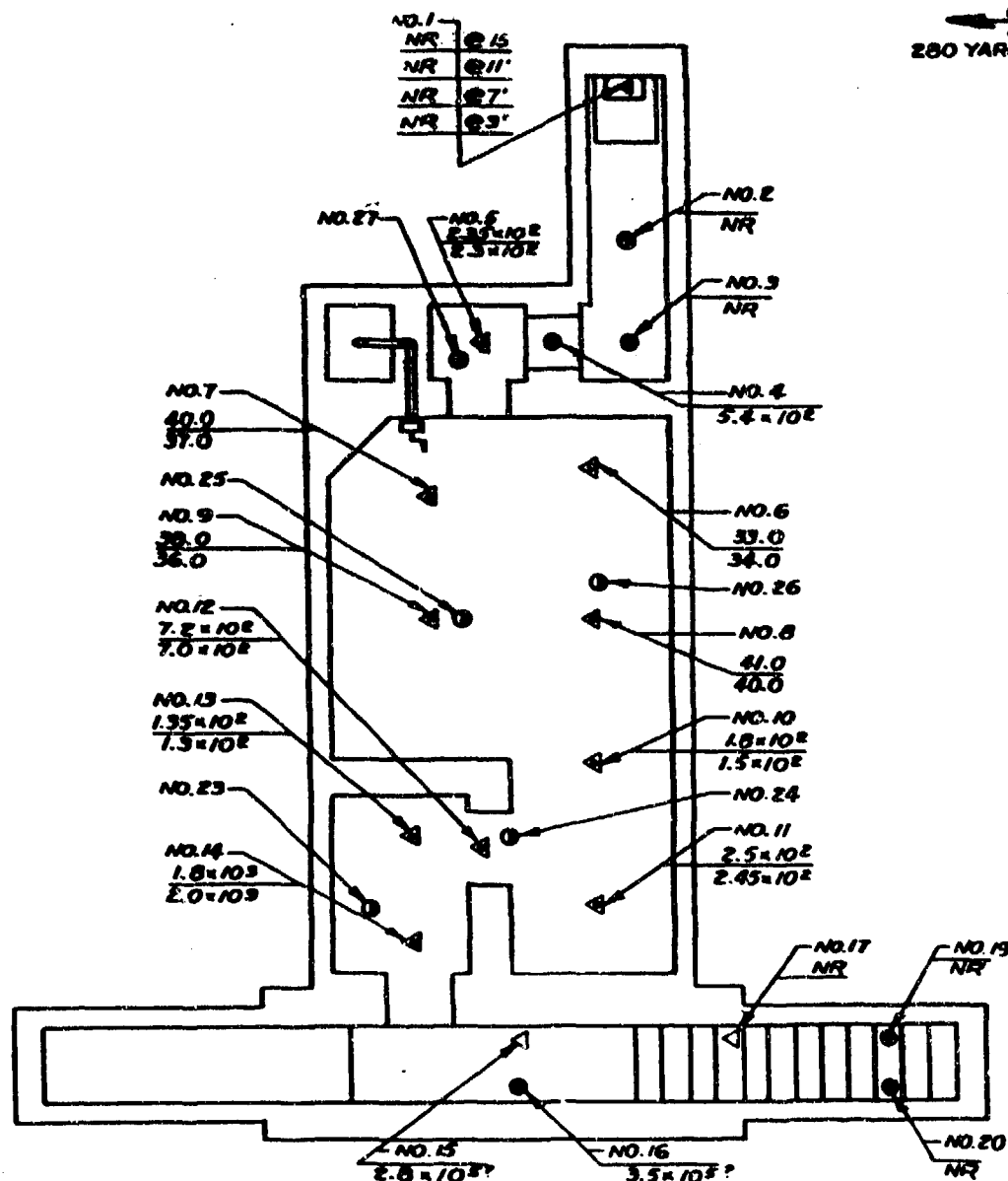


Fig. 3.35—Smoky, German shelter RA-a (rectangular; 8-30.7-8008). ●, EG&G film badges at a 3-ft height. ▲, EG&G film badges at a 5-ft height. △, EG&G film badges at 3- and 5-ft heights. □, EG&G film badges at indicated heights. ○, germanium detectors. The badges were placed at 3- and 5-ft heights. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively. NR, not recovered.

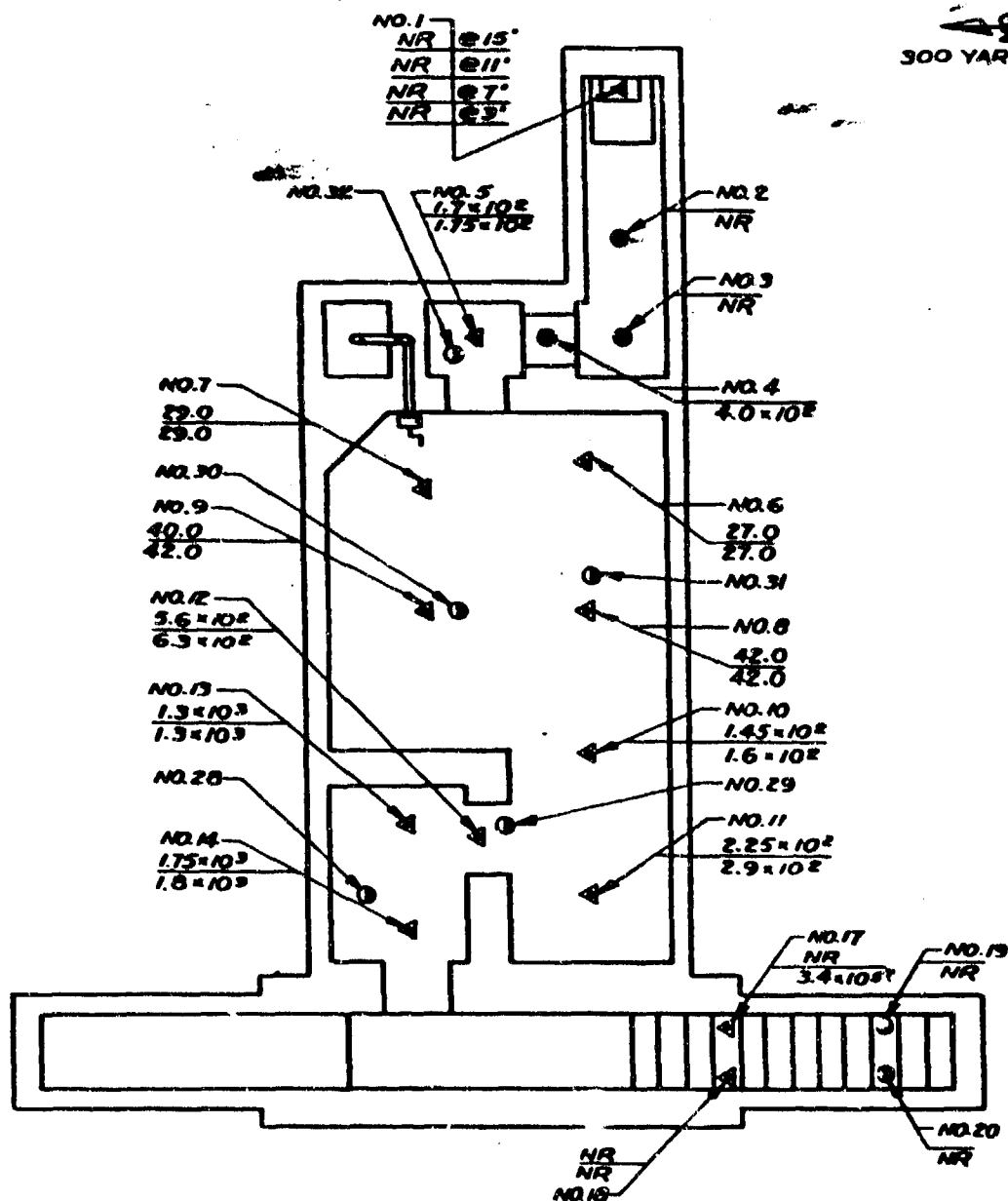


Fig. 3.36—Smoky, German shelter RA-b (rectangular; 8-30.7-8010). @, EG&G film badges at a 3-ft height. A, EG&G film badges at 3- and 5-ft heights. Δ, EG&G film badges at indicated heights. □, germanium detectors. The badges were placed at 3- and 5-ft heights. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively. NR: not recovered.

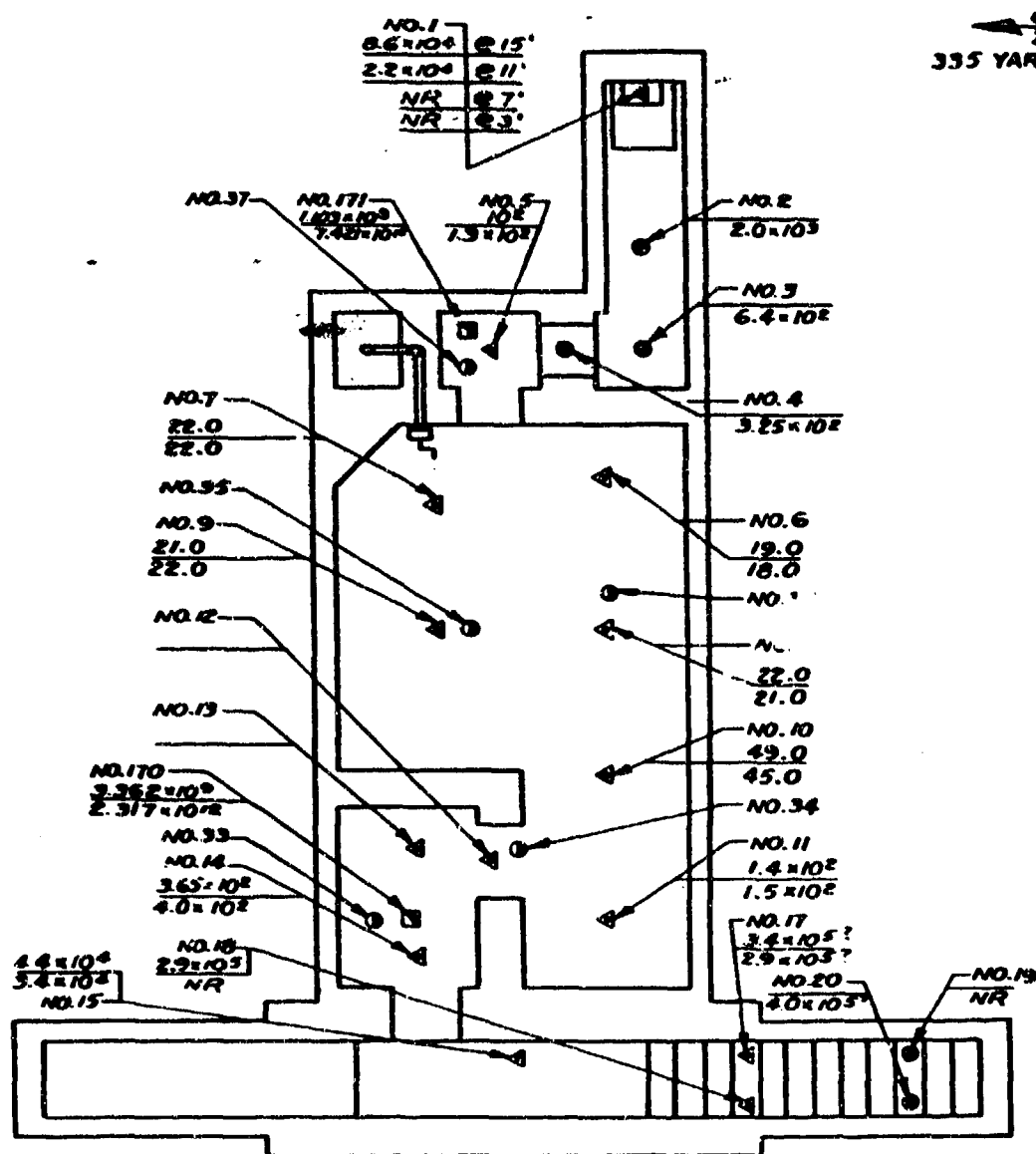


Fig. 3.37—Smoky, German shelter RA-c (circular; B-30.7-8011). ●, EG&G film badges at a 3-ft height. ▲, EG&G film badges at 3- and 5-ft heights. △, EG&G film badges at indicated heights. □, germanium detectors. ■, sulfur and gold detectors. The badges were placed at 3- and 5-ft heights. The doses in roentgens are given above and below the lines for the badges at the 5- and 3-ft heights, respectively. For the sulfur and gold detectors, the readings in neutrons per square centimeter are given above the lines for sulfur and below the lines for the gold-cadmium difference. NR: not recovered.

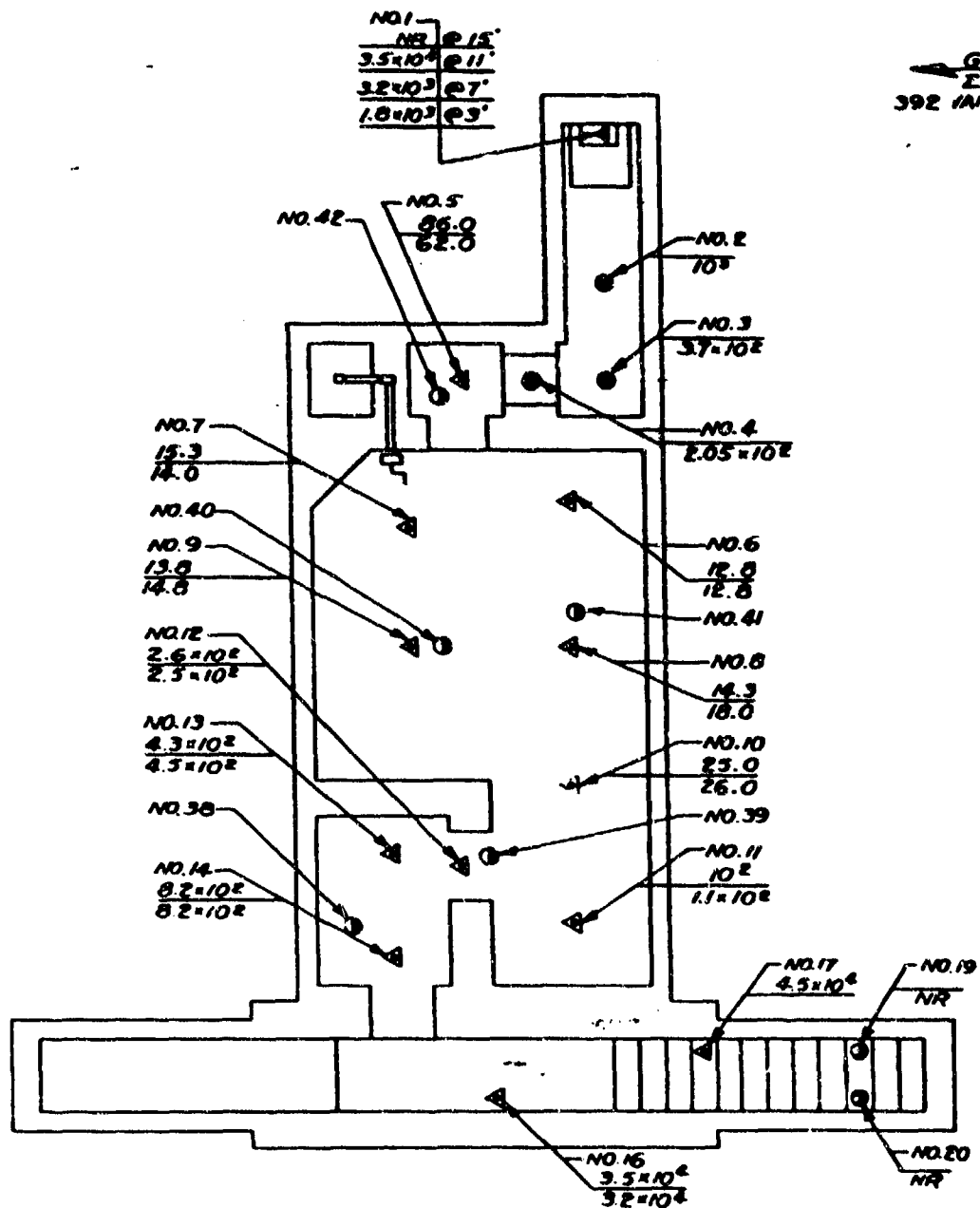


Fig. 3.38—Smoky, German shelter RA-4 (rectangular; B-30,7-2013). ●, EG&G film badges at a 3-ft height. ▲, EG&G film badges at 3- and 5-ft heights. △, EG&G film badges at indicated heights. ⊙, germanium detectors. The badges were placed at 3- and 5-ft heights. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively. NR: not recovered.

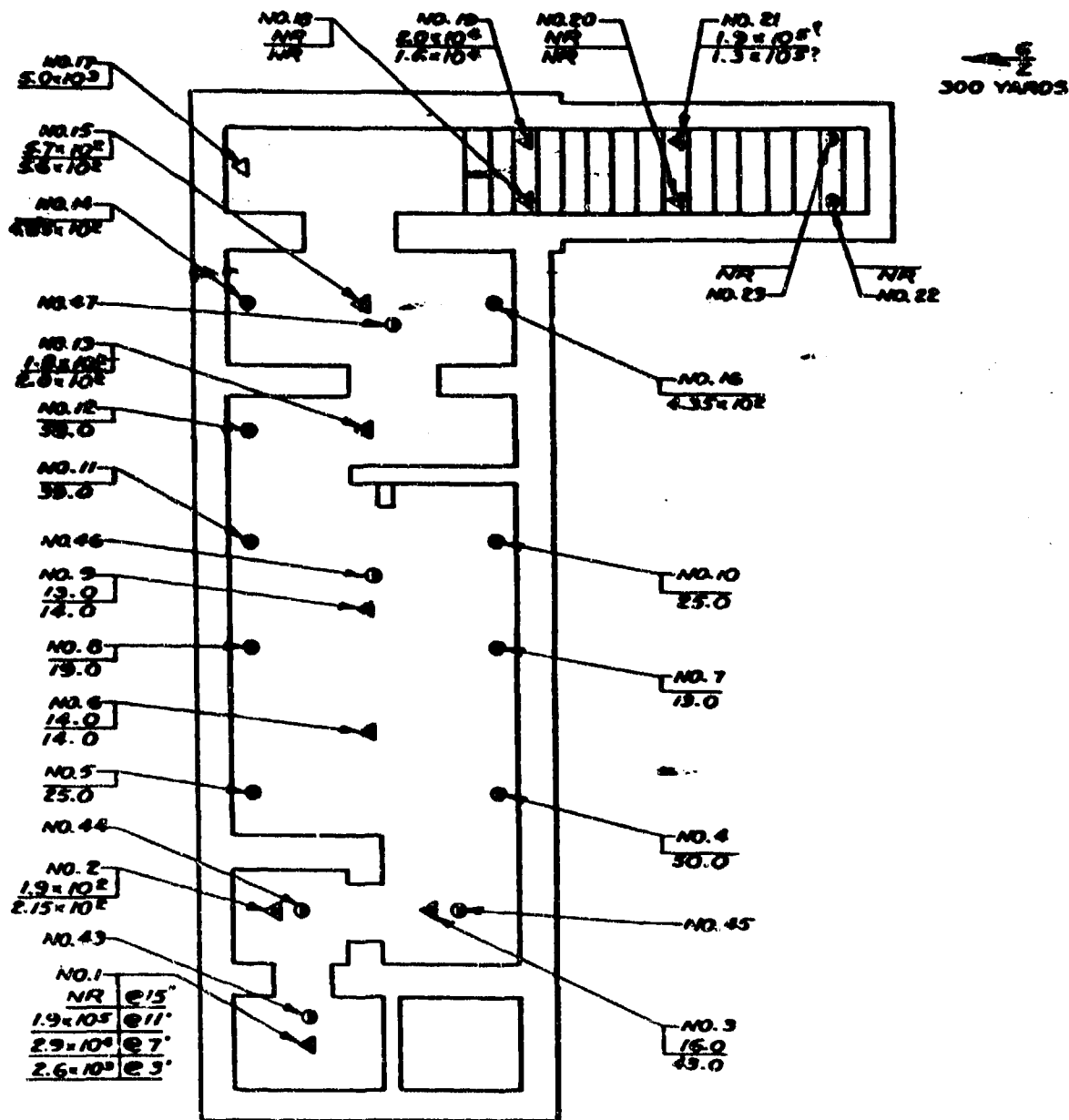
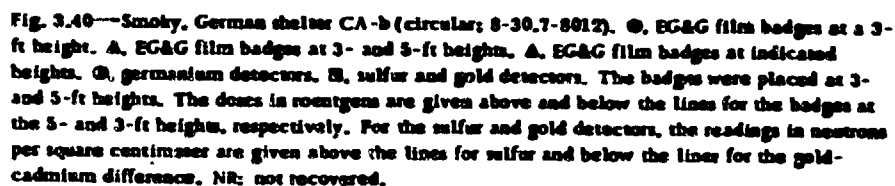


Fig. 3.39—Smoky, German shelter CA-a (circular; 8-30.7-8000). Δ, EG&G film badges at a 5-ft height. ⊙, EG&G film badges at a 3-ft height. ▲, EG&G film badges at 3- and 5-ft heights. △, EG&G film badges at indicated heights. ⊕, germanium detector. The badges were placed at 3- and 5-ft heights. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively. NR: not recovered.



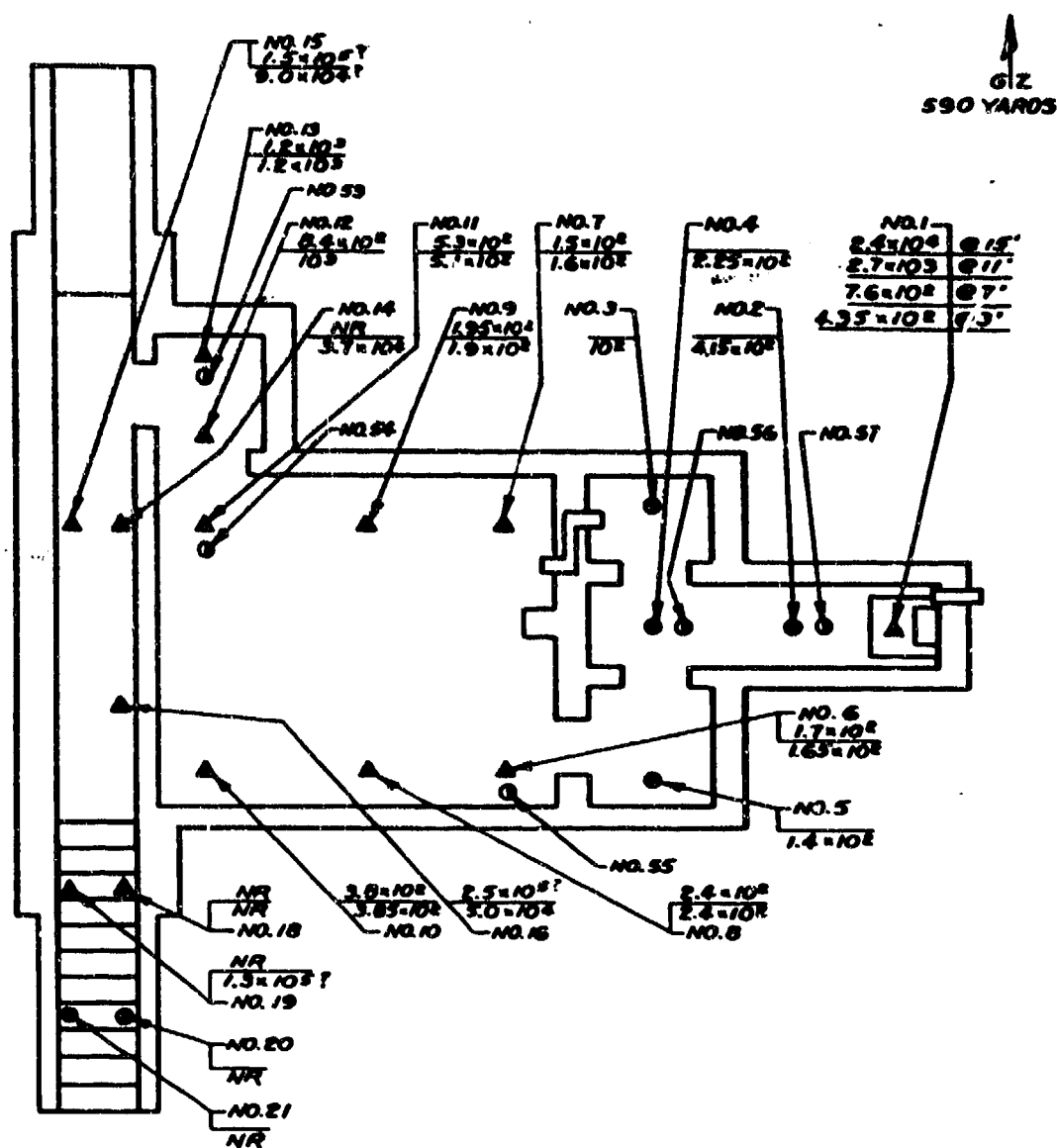


Fig. 3.41—Smoky, German shelter RC-a (rectangular; B-30.7-8014). ○, EG&G film badges at a 3-ft height. △, EG&G film badges at 3- and 5-ft heights. □, EG&G film badges at indicated heights. □, germanium detectors. The badges were placed at 3- and 5-ft heights. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively. NR: not recovered.

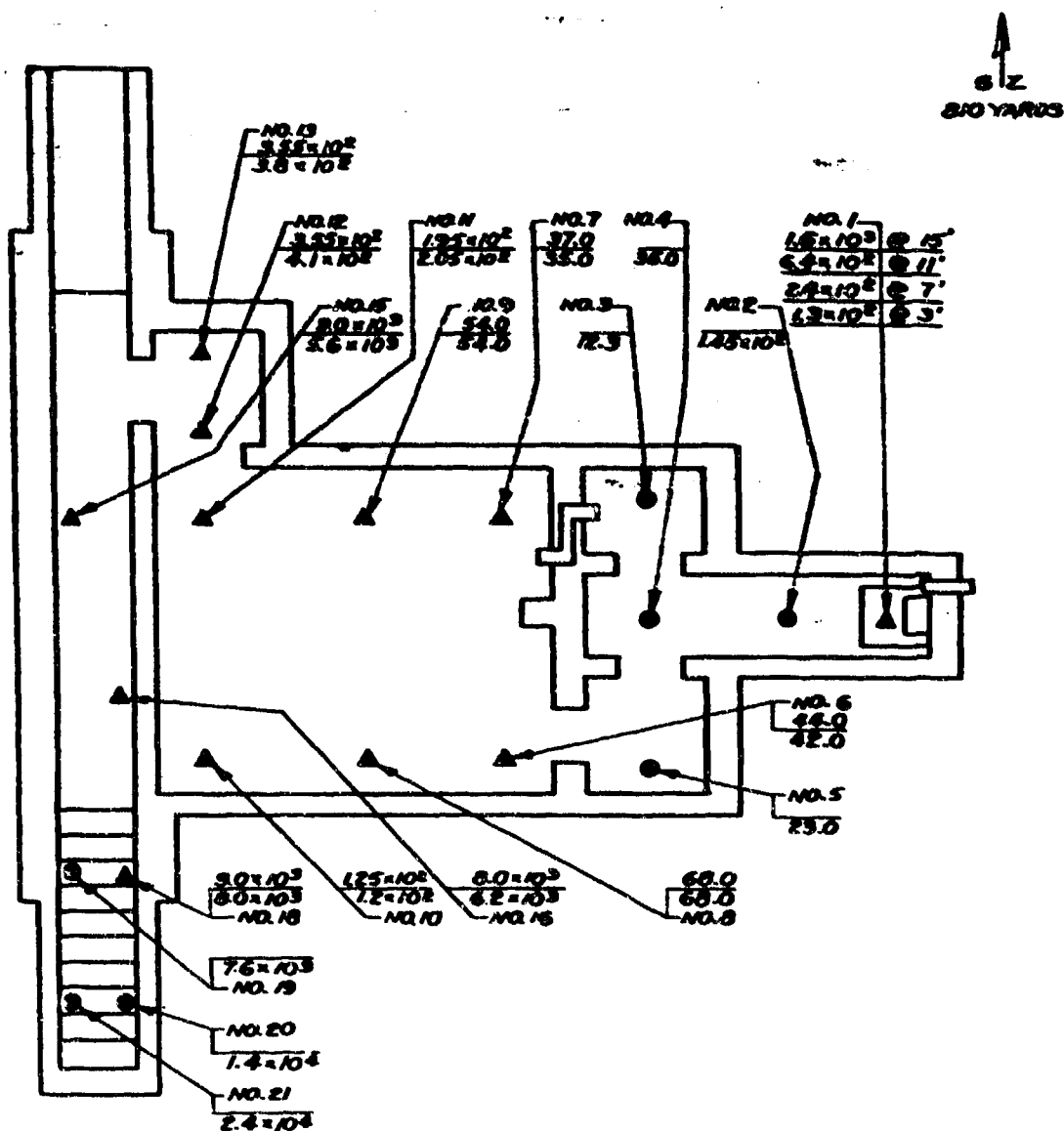


Fig. 3.42—Smoky, German shelter RC-b (rectangular; 8-30,7-8015). ●, EG&G film badges at a 3-ft height, ▲, EG&G film badges at 3- and 5-ft heights, △, EG&G film badges at indicated heights. The badges were placed at 3- and 5-ft heights. The readings above and below the lines are the doses in roentgens at the 3- and 5-ft heights, respectively.

612
1440 YARDS

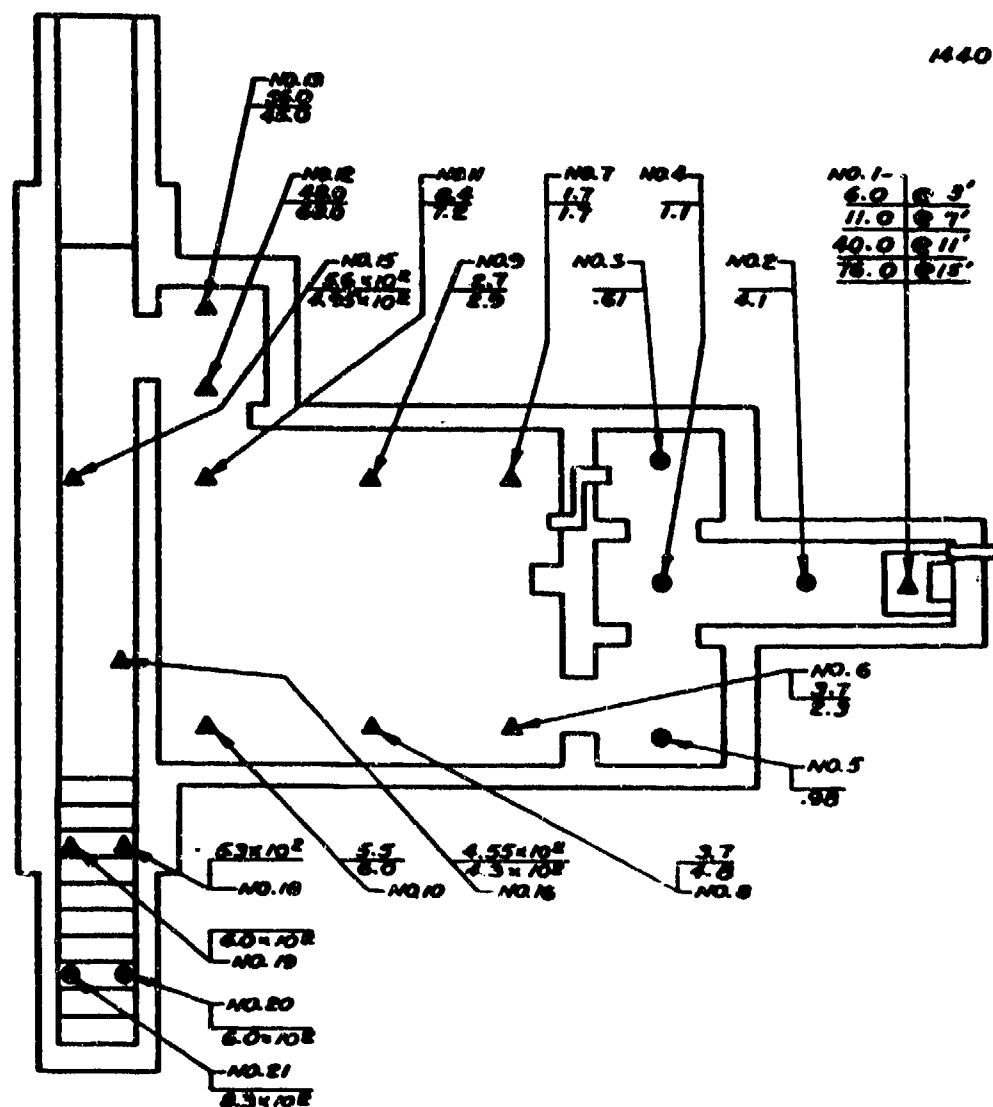
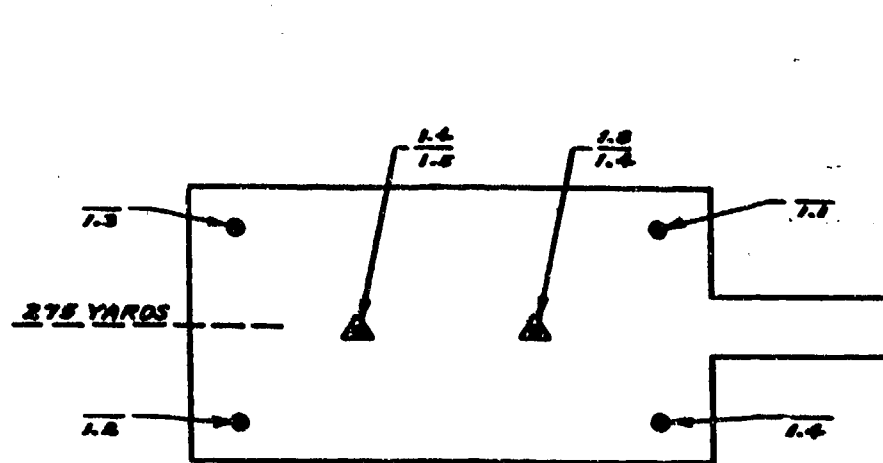
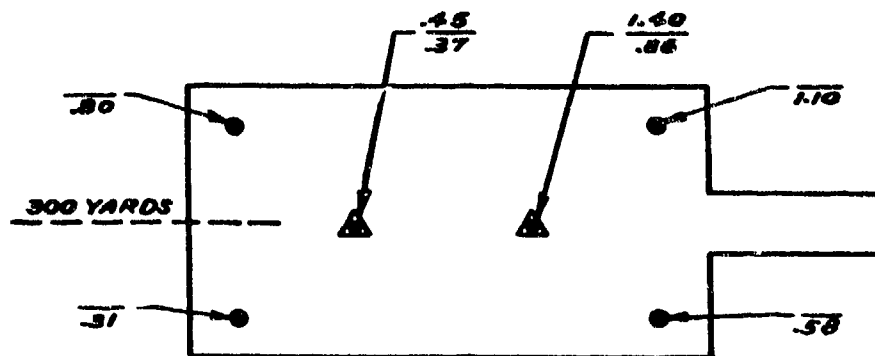


Fig. 3.43—Smoky. German shelter BC-c (rectangular; 3-30.7-8016). @, EG&G film badges at a 3-ft height. A, EG&G film badges at 3- and 5-ft heights. Δ, EG&G film badges at indicated heights. The badges were placed at 3- and 5-ft heights. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively.



SHELTER NO. 1



SHELTER NO. 2

Fig. 3.44—Smoky, Holmes and Narver shelters 1 and 2. @, EG&G film badges at a 3-ft height. A, EG&G film badges at 3- and 5-ft heights. The badges were placed at 3- and 5-ft heights. The readings above and below the lines are the doses in roentgens at the 5- and 3-ft heights, respectively. These badges were recovered approximately $1\frac{1}{2}$ months later than those from other shelters.

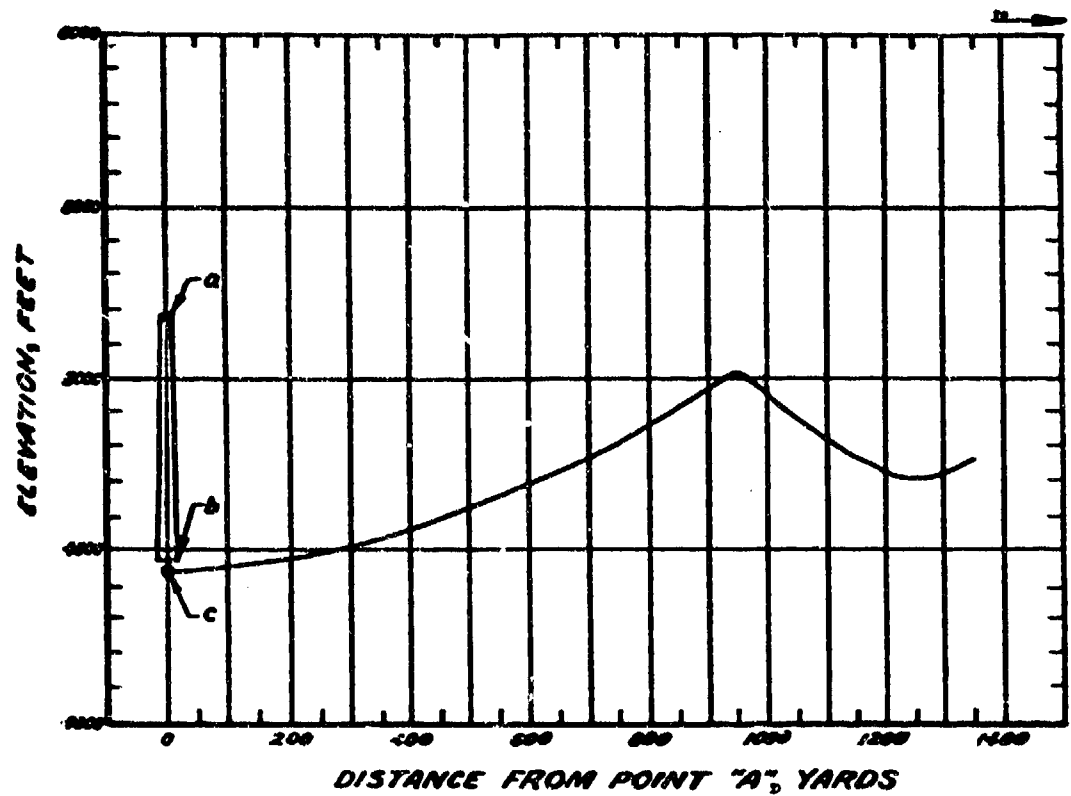


Fig. 3.45—Smoke, north-line elevation. a, top of tower. b, base of tower. c, point A (not GZ).

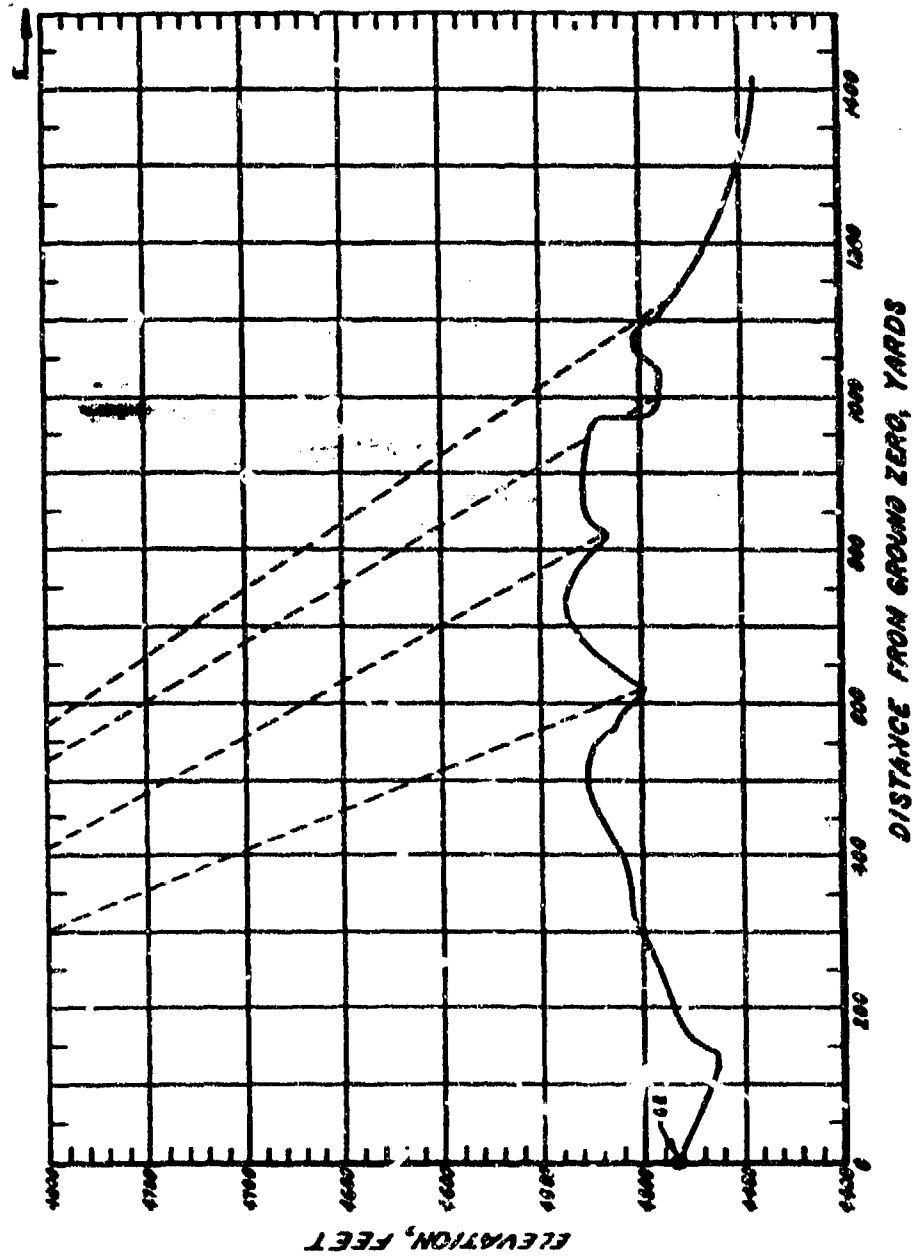


Fig. 3.46 — Smoky, east-line elevation.

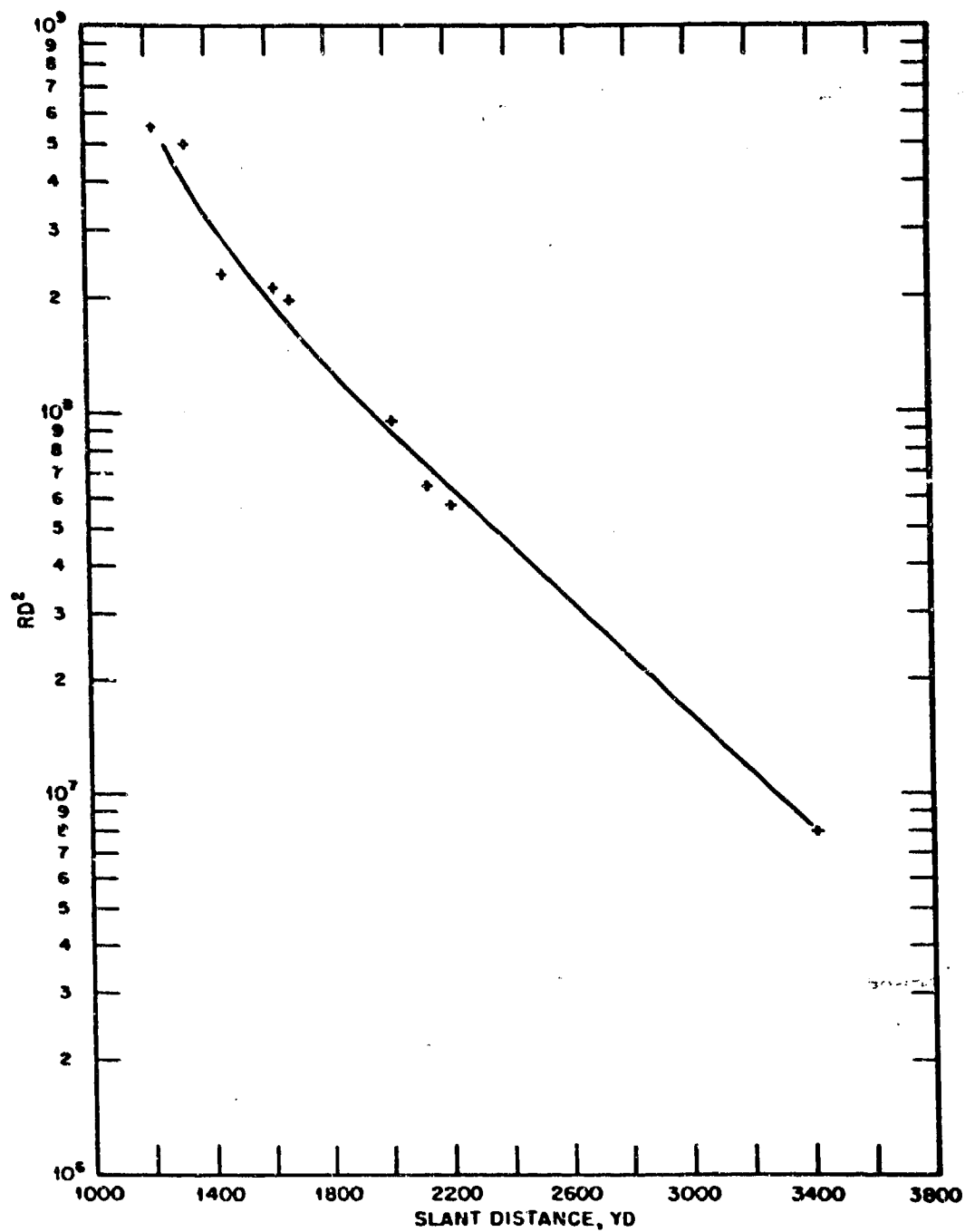


Fig. 3.47—Galileo, southeast stake line, RD^2 vs. D .

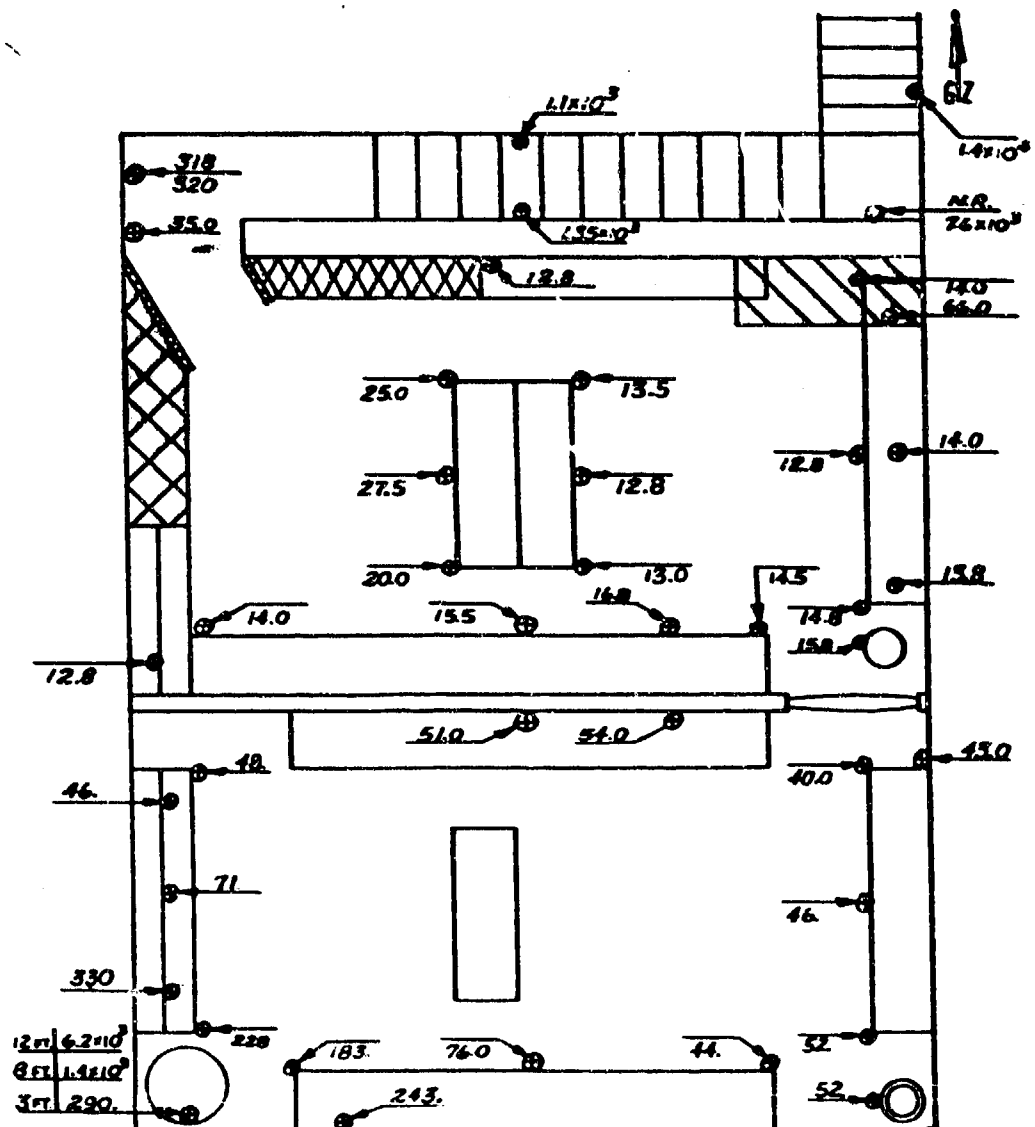


Fig. 3.48—Galileo, Project 33.1 animal shelter. The readings above the lines are the doses in roentgens at the 5-ft height; the readings below the lines are the doses in roentgens at the 1.5-ft height unless otherwise noted.

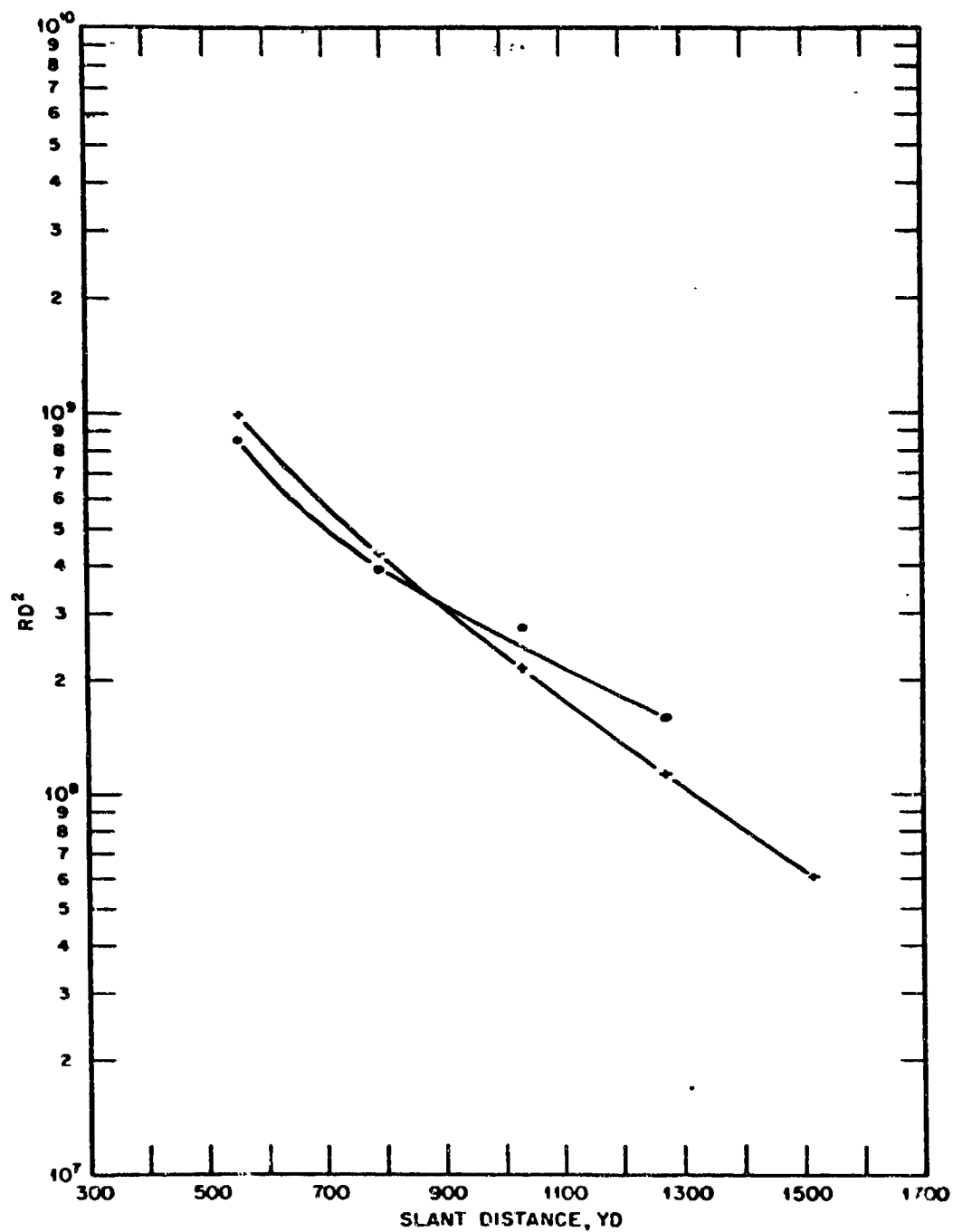


Fig. 3.49—La Place, goal-post line, RD^2 vs. D. +, EG&G film badges. O, film in lithium can.

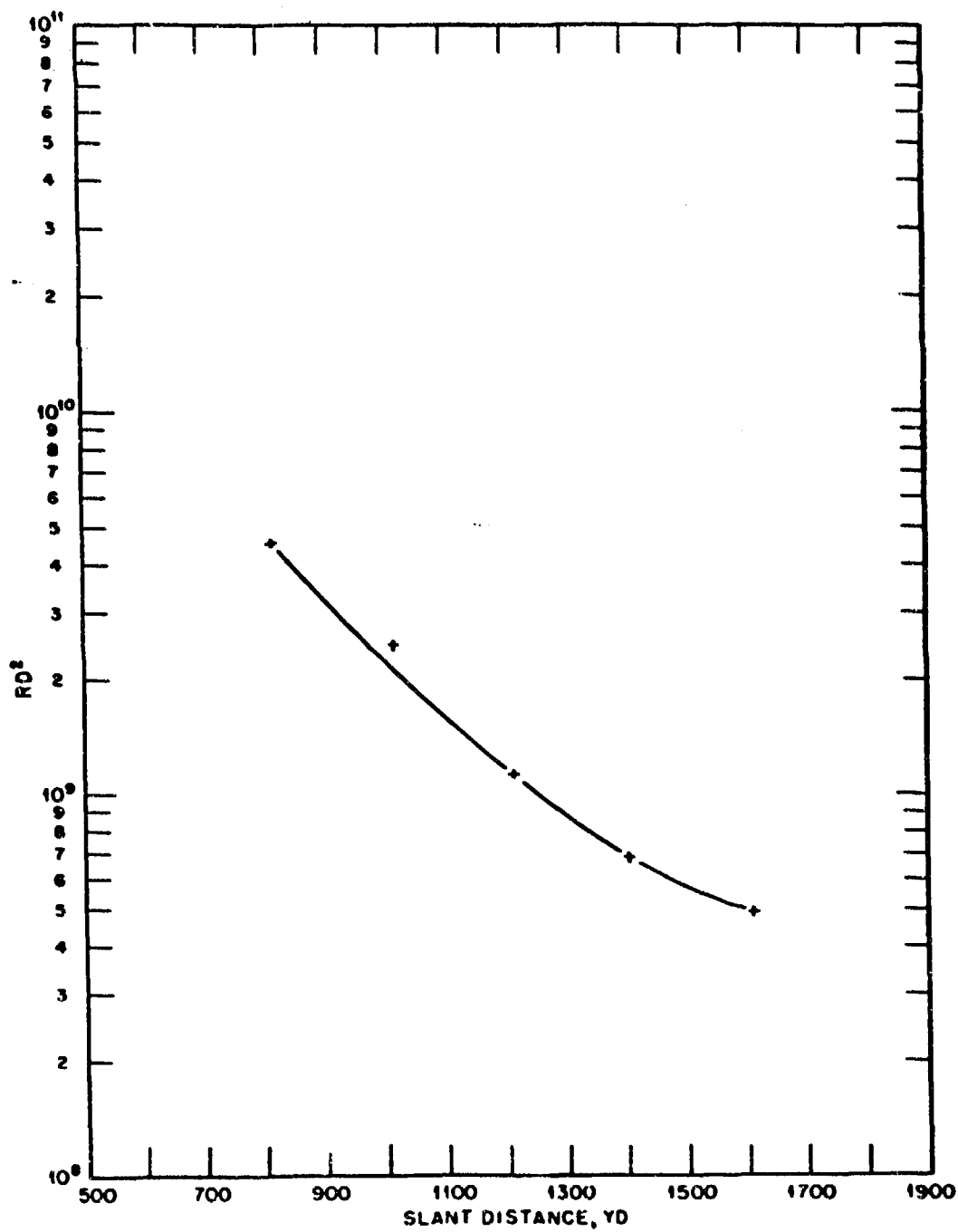


Fig. 3.50—Fizeau, goal-post line, RD^3 vs. D.

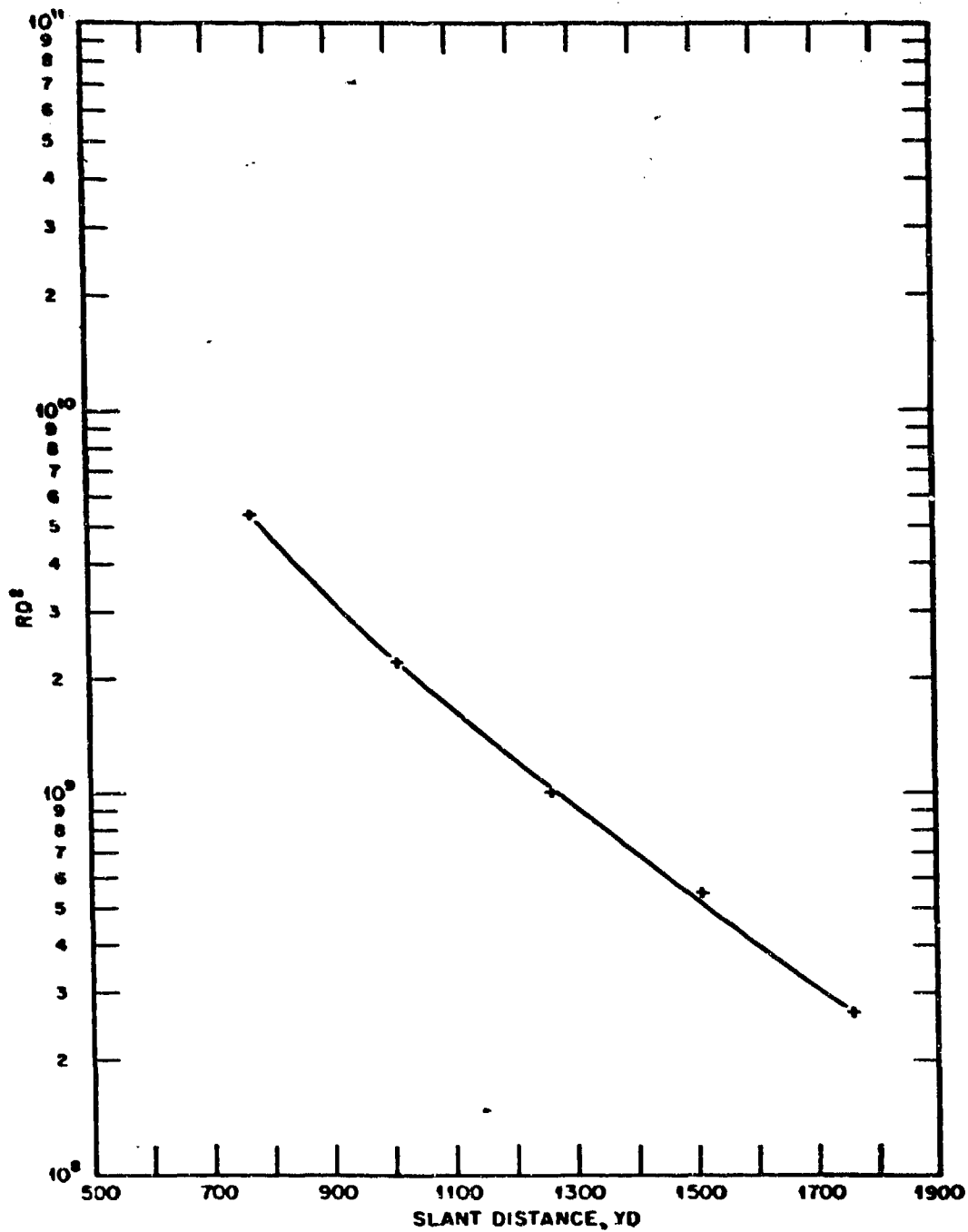


Fig. 3.51—Whitney, goal-post line, RD^2 vs. D. ----

TABLE 3.1 — FRANKLIN, NORTH STAKE LINE AND GOAL POST*

Slant distance (D), yd	D ²	Dose in EG&G container, r	RD ²	No. of EG&G badges per point	Maximum deviation per point, %	Film types read
North Stake Line						
510	2.6×10^5	557.5	1.45×10^7	2	1.35	1112; 606
609	3.7×10^5	337.5	1.25×10^7	2	9.63	1112; 606
707	5.0×10^5	188.3	9.42×10^7	2	6.21	1112; 606; 510
806	6.5×10^5	95.0	6.37×10^7	2	4.08	510
905	8.2×10^5	69.6	5.7×10^7	2	0.72	510
1005	1.01×10^6	46.0	4.65×10^7	2	0.0	510
1104	1.22×10^6	26.6	3.51×10^7	2	3.58	510
1204	1.45×10^6	†				
1303	1.70×10^6	11.1	1.89×10^7	2	8.11	502; 510
1403	1.97×10^6	7.3	1.44×10^7	2	2.85	502
1503	2.26×10^6	4.98	1.12×10^7	2	5.05	502
Goal Post						
510	2.6×10^5	360.0	9.36×10^7	1		1112
609	3.7×10^5	179.0	6.29×10^7	1		510; 606
707	5.0×10^5	114.0	5.7×10^7	1		510; 606
806	6.5×10^5	†				
905	8.2×10^5	42.0	3.44×10^7	1		510
1004	1.01×10^6	†				
1104	1.22×10^6	13.0	1.59×10^7	1		502
1303	1.7×10^6	5.6	9.52×10^6	1		502
1503	2.26×10^6	2.6	6.33×10^6	1		502

*Dose vs. distance: RD² vs. D.

†Not recovered.

TABLE 3.1—FRANKLIN, SOUTH STAKE LINE AND GOAL POST*

Slant distance (D), yd	D ²	Dose in EG&G con- tainer, r	RD ²	No. of EG&G badges per point	Maximum deviation per point, %	Film types read
South Stake Line						
835	2.86×10^5	375.5	1.07×10^8	2	0.8	1112
633	4.01×10^5	210.0	8.42×10^7	2	9.52	510; 406
732	5.36×10^5	125.0	6.7×10^7	2	0.0	510
831	6.91×10^5	86.0	5.94×10^7	2	0.0	510
930	8.65×10^5	50.5	4.37×10^7	2	2.97	510
1029	1.06×10^6	31.3	3.31×10^7	2	2.56	510
1131	1.28×10^6	21.3	2.73×10^7	2	3.76	510
1229	1.51×10^6	13.1	1.98×10^7	2	14.5	510; 502
1330	1.77×10^6	7.35	1.3×10^7	2	0.68	503
1428	2.04×10^6	5.60	1.14×10^7	2	0.0	502
1530	2.34×10^6	4.0	9.36×10^6	2	0.0	502
Goal Post						
732	5.36×10^5	90.0	4.82×10^7	1		510
816	6.66×10^5	†				
831	6.91×10^5	46.0	3.17×10^7	1		510
930	8.65×10^5	36.0	3.29×10^7	1		510
1029	1.06×10^6	25.0	2.65×10^7	1		510
1127	1.27×10^6	14.0	1.87×10^7	1		510

*Dose vs. distance: RD² vs. D.

†Not recovered.

TABLE 3.3—WILSON, SOUTHEAST GOAL-POST LINE*

Slant distance (D), yd	D ²	Dose in EG&G con- tainer, r	RD ²	No. of EG&G badges per point	Film types read
527	2.78×10^5	2.0×10^3	5.56×10^{10}	1	1112
647	4.19×10^5	4.0×10^3	2.05×10^{11}	1	1112
768	5.9×10^5	10^4	5.90×10^9	1	1112
1014	1.03×10^6	2.4×10^3	2.47×10^9	1	1112
1259	1.59×10^6	620.0	9.66×10^9	1	1112
1510	2.28×10^6	255.0	5.81×10^9	1	606; 1112
1760	3.09×10^6	91.0	2.8×10^9	1	510
2010	4.03×10^6	48.0	1.83×10^9	1	510

*Dose vs. distance: RD² vs. D.

TABLE 3.4—PRISCILLA, STAKE LINE*

Slant distance (D), yd	D ²	Dose in EG&G con- tainer, r	RD ²	No. of EG&G badges per point	Maximum deviation per point, %	Film types read
410	1.68×10^5	†				
470	2.21×10^5	†				
500	2.5×10^5	†				
540	3.14×10^5	†				
650	4.23×10^5	†				
800	7.4×10^5	†				
1000	1.0×10^6	†				
1104	1.22×10^6	5.2×10^3	6.34×10^9	2	0.0	1112
1296	1.68×10^6	1.5×10^3	2.52×10^9	2	0.0	1112
1383	1.91×10^6	†				
1477	2.18×10^6	†				
1496	2.24×10^6	725.0	1.62×10^9	2	0.69	1112
1694	2.87×10^6	327.5	9.4×10^8	2	0.76	606
1773	3.14×10^6	†				
1892	3.58×10^6	168.5	6.03×10^8	2	3.56	510
2090	4.37×10^6	122.5	5.35×10^8	2	2.04	510
2289	5.24×10^6	69.0	3.61×10^8	2	1.45	510

*Dose vs. distance: RD² vs. D.

†Not recovered.

TABLE 3.6—HOOD, GOAL-POST LINE*

Slant distance (D), yd	D ²	Dose in EG&G counter, r	Dose in Li can, r _{Li}	RD ²	R _{Li} D ²	No. of EG&G badges per point	Maximum deviation per point, %	No. of Li cans per point	Maximum deviation per point, %	Film types read
1117	1.25 × 10 ⁶	2.85 × 10 ⁴	2.0 × 10 ⁴	3.56 × 10 ¹⁰	2.5 × 10 ¹⁰	4	8.3	2	0.0	1112
1343	1.81 × 10 ⁶	6.6 × 10 ⁴	4.2 × 10 ⁴	1.17 × 10 ¹⁰	7.6 × 10 ⁹	4	4.6	2	7.1	1112
1581	2.5 × 10 ⁶	2.06 × 10 ⁴	1.58 × 10 ⁴	5.13 × 10 ⁹	3.95 × 10 ⁹	4	2.4	2	1.9	1112
1818	3.31 × 10 ⁶	6.85 × 10 ⁴	6.0 × 10 ⁴	2.27 × 10 ⁹	1.99 × 10 ⁹	4	9.73	2	0.0	1112
2082	4.35 × 10 ⁶	3.19 × 10 ⁴		1.36 × 10 ⁹		4	2.6			1112

*Dose vs. distance: RD² vs. D.

TABLE 3.6—DIABLO, GOAL-POST LINE*

Slant distance (D), yd	D ²	Dose in EG&G counter, r	Dose in Li can, r _{Li}	RD ²	R _{Li} D ²	No. of EG&G badges per point	Maximum deviation per point, %	No. of Li cans per point	Maximum deviation per point, %	Film types read
527	2.78 × 10 ⁵	4.78 × 10 ⁴		1.31 × 10 ¹⁰		3	35.0			1112
623	3.88 × 10 ⁵	1.64 × 10 ⁴		6.36 × 10 ⁹		4	22.0			1112
719	5.18 × 10 ⁵	9.5 × 10 ³	6.0 × 10 ³	4.92 × 10 ⁹	3.11 × 10 ⁹	4	9.47	3	53.3	1112
817	6.67 × 10 ⁵	5.85 × 10 ³		2.7 × 10 ⁹		4	8.11			1112
916	8.37 × 10 ⁵	2.97 × 10 ³		2.49 × 10 ⁹		4	9.09			1112
1014	1.03 × 10 ⁶	1.84 × 10 ³	1.2 × 10 ³	1.61 × 10 ⁹	1.24 × 10 ⁹	4	5.77	3	20.8	1112
1112	1.24 × 10 ⁶	977.0		1.31 × 10 ⁹		4	2.76			1112
1212	1.47 × 10 ⁶	688.0	580.0	9.82 × 10 ⁸	6.53 × 10 ⁸	4	6.29	3	5.2	1112
1311	1.72 × 10 ⁶	488.0		8.66 × 10 ⁸		4	4.70			606
1410	1.99 × 10 ⁶	378.0		7.5 × 10 ⁸		4	2.12			606
1508	2.28 × 10 ⁶	288.0	263.0	6.79 × 10 ⁸	6.0 × 10 ⁸	4	4.03	3	14.1	606
1608	2.59 × 10 ⁶	198.0		4.79 × 10 ⁸		4	2.7			510

*Dose vs. distance: RD² vs. D.

TABLE 3.7—KEPLER, GOAL-POST LINE*

Slant distance (D), yd	D ²	Dose in EG&G counter, r	Dose in Li can, r _{Li}	RD ²	R _{Li} D ²	No. of EG&G badges per point	Maximum deviation per point, %	Maximum deviation per point, %	Film types read
527	2.78×10^4	4.7×10^2	5.3×10^2	1.31×10^3	1.48×10^3	4	8.5	7.7	1112
1014	1.03×10^5	3.84×10^3	4.48×10^3	2.86×10^4	4.61×10^4	4	3.6	7.1	606; 1112
1510	2.28×10^5	46.5	49.5	1.06×10^5	1.13×10^5	4	1.1	1.0	510

*Dose vs. distance: RD² vs. D.

TABLE 3.8—STOKES, GOAL-POST LINE*

Slant distance (D), yd	D ²	Dose in EG&G counter, r	Dose in Li can, r _{Li}	RD ²	R _{Li} D ²	No. of EG&G badges per point	Maximum deviation per point, %	Maximum deviation per point, %	Film types read
902	8.14×10^4	8.0×10^2	4.9×10^2	6.51×10^3	3.99×10^3	4	0.0	0.0	1112
1116	1.25×10^5	2.2×10^3	1.6×10^3	2.78×10^4	2.0×10^4	4	4.6	0.0	1112
1346	1.81×10^5	7.15×10^3	5.9×10^3	1.29×10^5	1.07×10^5	4	2.1	1.69	1112
1580	2.5×10^5	2.83×10^4	2.05×10^4	7.33×10^5	7.83×10^5	4	2.3	1.64	606
1818	3.31×10^5	10^5	3.31×10^4			4	0.0		510
2060	4.24×10^5	55.0	2.33×10^4			4	5.2		510

*Dose vs. distance: RD² vs. D.

TABLE 3.9—SHASTA, GOAL-POST LINE*

Slant distance (D), yd	D ²	Dose in EG&G counter, r	Dose in Li can, r _{Li}	RD ²	No. of EG&G badges per point	Maximum deviation per point, %	Film types read
766	5.9×10^4	5.55×10^2		3.37×10^3	4	6.3	1112
1014	1.03×10^5	1.44×10^3		1.48×10^4	4	4.2	1112
1260	1.58×10^5	506.7		9.06×10^4	4	0.73	606
1509	2.28×10^5	214.2		4.88×10^5	4	4.3	510; 606

*Dose vs. distance: RD² vs. D.

TABLE 3.10—DOPPLER, GOAL-POST LINE*

Slant distance (D), yd	D ²	Dose in EG&G counter, F	Dose in Li can, F _{Li}	RD ²	R _{Li} D ²	No. of EG&G badges per point	Maximum deviation per point, %	No. of Li cans per point	Maximum deviation per point, %	Film types read
902	8.14×10^3	1.97×10^4	2.9×10^4	1.6×10^{10}	1.63×10^{10}	3	12.7	3	9.0	1112
1116	1.26×10^4	3.23×10^4	3.3×10^4	4.9×10^9	4.13×10^9	3	2.5	3	5.1	1112
1346	1.81×10^4	973.3	960.0	1.76×10^9	1.72×10^9	3	2.7	3	2.2	1112
1580	2.5×10^4	435.0	466.3	1.06×10^9	1.14×10^9	3	2.5	3	5.3	606, 1112
1818	3.31×10^4	191.7	†	6.36×10^8	†	3	9.6	†	†	606
2060	4.24×10^4	101.3	†	4.3×10^8	†	4	1.7	†	†	510

*Dose vs. distance: RD² vs. D.

TABLE 3.11—FRANKLIN PRIME, GOAL-POST LINE*

Slant distance (D), yd	D ²	Dose in EG&G counter, F	Dose in Li can, F _{Li}	RD ²	R _{Li} D ²	No. of EG&G badges per point	Maximum deviation per point, %	No. of Li cans per point	Maximum deviation per point, %	Film types read
559	3.13×10^3	1.4×10^4	1.55×10^4	4.38×10^9	4.55×10^9	4	14.3	3	5.7	1112
791	6.26×10^3	1.88×10^4	1.75×10^4	1.16×10^9	1.09×10^9	4	1.6	3	11.4	1112
1029	1.06×10^4	539.0	497.3	5.71×10^8	5.27×10^8	4	2.9	3	4.8	606, 1112
1272	1.63×10^4	198.7	176.3	3.08×10^8	2.87×10^8	4	7.3	3	3.5	510, 606
1519	2.31×10^4	58.4	†	1.35×10^8	†	4	.06	†	†	510
1769	3.13×10^4	14.3	†	4.93×10^7	†	4	2.9	†	†	502

*Dose vs. distance: RD² vs. D.

†No badge was exposed in lithium can.

TABLE 3.12—SMOKY, FRENCH AND EG&G DOSIMETRY COMPARISON

Shelter No.	Inside location	5-ft French plate		5-ft EG&G badge		5-ft EG&G badge		3-ft EG&G badge	
		No.	Av. dose, r (Cd)	No.	Dose, r	No.	Dose, r	No.	Dose, r
II-1	24	51	2.78	1979	1.5			1978	1.9
II-1	20 and 21	52	3.72	1970	1.0	1971	1.7	1972	2.3
II-1	16	53	24.50	1962	7.4	1963	7.4		
II-1	33	54	3.36	2564	2.7	2565	2.7	2566	2.7
II-1	35 and 36	55	10.60*	2570	8.7			2569	5.4
II-1	1	56	8.9×10^2 *	1937	7.0×10^2 †	1936	1.0×10^2 ‡	1935	1.6×10^2
II-1	39	57	35.	2580	31.0	2579	27.0	2578	31.0
II-2	5 and 6	59	17.88	2512	26.0	2511	25.0	2510	19.0
II-2	19 and 20	60	26.00	1918	15.0	1917	12.0	1916	18.0
II-2	14 and 15	61	23.13	1909	42.0	1908	38.0	1907	30.0
II-2	9 and 10	62	205.50	2516	24.0	2519	22.0	2517	19.0
II-3	3 and 4	44 and 45	19.44	2521	22.0	2522	21.5		
II-3	8 and 9	46	27.50	2520	30.0	2528	35.0	2527	34.0
II-4	5 and 6	67	24.50				33.0†		36.0**
II-4	9 and 10	68	24.38	2497	53.0	2496	53.0		
II-5	3 and 4	71	19.36	2476	28.0	2477	25.0		
II-5	8 and 9	72	34.13	2484	45.0	2486	46.0	2485	54.0

*Recovered one month later than the other badges.

†At 11 ft.

‡At 7 ft.

§3 and 4 were not recovered.

¶Average dose at 5 ft for Nos. 2494 and 2496.

**Average dose for Nos. 2493 and 2495.

TABLE 3.13—SMOKY, SLANT-RANGE CALCULATION, NORTH LINE

Distance from GZ, yd	Elevation above GZ, ft	Slant range, yd
450	+80	498
600	+130	629
700	+210	719
825	+360	833
900	+480	903
930	+520	933
1000	+470	1003
1100	+350	1106
1200	+260	1209
1300	+240	1309

TABLE 3.14—SMOKY, NORTH GOAL-POST LINE*

Slant distance (D), yd	D ²	Dose in EG&G con- tainer, r	RD ²	No. of EG&G badges per point	Maximum deviation per point, %	Film types read
498	2.49×10^5	$\sim 10^5?$	2.49×10^{11}	2	0	1112
629	3.96×10^5	$9.00 \times 10^5?$	3.56×10^{11}	2	11.1	1112
719	5.18×10^5	$2.00 \times 10^5?$	1.04×10^{11}	2	20.0	1112
833	6.94×10^5	$6.50 \times 10^4?$	4.52×10^{10}	2	10.7	1112
903	8.16×10^5	2.75×10^4	2.24×10^{10}	2	20.0	1112
933	8.72×10^5	2.45×10^4	2.14×10^{10}	2	2.0	1112
1003	1.01×10^6	2.70×10^3	2.73×10^9	2	7.4	1112
1106	1.22×10^6	1.70×10^3	2.07×10^9	2	0	1112
1209	1.46×10^6	0.35	5.11×10^9	2	5.7	502
1309	1.71×10^6	0.33	5.64×10^9	2	15.1	502

*Dose vs. distance: RD² vs. D.

TABLE 3.15--SMOKY. SLANT-RANGE CALCULATION, EAST LINE

Distance from GZ, yd	Elevation above GZ, ft	Slant range, yd
400	+30	458
500	+45	545
565	+38	607
610	+21	651
660	+44	691
725	+58	736
780	+46	810
811	+38	841
880	+48	887
965	+41	940
965	+30	990
975	+16	1001
1000	+12	1026
1090	+21	1098
1140	+2	1164
1250	-20	1268
1400	-38	1421
1600	-30	1618
1800	-20	1816

TABLE 3.16--SMOKY, EAST GOAL-POST LINE*

Slant distance (D), yd	D ²	Dose EG&G con- tainer, r	RD ²	No. of EG&G badges per point	Maximum deviation per point, %	Film types read
756	5.72×10^5	1.55×10^3 ?	8.88×10^{10}	2	23	1112
810	6.56×10^5	4.70×10^4	3.08×10^{10}	2	4.3	1112
841	7.07×10^5	2.40×10^4	1.70×10^{10}	2	0	1112
887	7.87×10^5	3.20×10^4	2.52×10^9	2	6.1	1112
960	9.60×10^5	8.70×10^4	8.35×10^9	2	1.1	1112
990	9.80×10^5	4.99×10^4	4.80×10^{10}	2	10.2	1112
1001	1.00×10^6	4.10×10^4	4.10×10^9	2	2.4	1112
1026	1.05×10^6	6.50×10^4	6.82×10^9	2	1.5	1112
1098	1.21×10^6	4.05×10^4	4.90×10^9	2	13.6	1112
1164	1.36×10^6	2.50×10^4	3.40×10^9	2	8.0	1112
1268	1.61×10^6	1.80×10^4	2.90×10^9	2	0	1112
1421	2.02×10^6	7.50×10^4	1.52×10^9	4	6.7	1112; 508
1618	2.62×10^6	4.15×10^4	1.09×10^9	4	10.8	1112; 608
1816	3.30×10^6	2.18×10^4	7.20×10^8	6	23.8	1112; 608

510

*Dose vs. distance: RD² vs. D.

TABLE 3.17—SMOKY, IRON-PIPE CONTAINER DATA

Location of iron-pipe container, yd from GZ	Badge No.	Type 502		Type 510		Type 606		Type 1112		Interpreted EG&G dose
		Density	Dose	Density	Dose	Density	Dose	Density	Dose	
100	1741	1.76		5.53		4.48		3.37	$\sim 5 \times 10^3$	$\sim 5 \times 10^3$
200	1742	1.87		5.71		4.37		3.25	$\sim 2 \times 10^4$	$\sim 2 \times 10^4$
300	1743	1.85		5.61		4.03		3.00	2.1×10^4	2.1×10^4
400	1744	1.94		5.36		3.55		2.74	4.6×10^4	4.6×10^4
450	1745	1.93		5.14		3.26		2.54	1.9×10^4	1.9×10^4
450	1746	1.91		5.11		3.22		2.54	1.9×10^4	1.9×10^4
500	1747	1.92		4.81		2.94		2.38	10^4	10^4
600	1748	1.91		4.13		2.46		2.08	3.4×10^3	3.4×10^3
700	2179	1.81		3.49		1.94		1.72	1.7×10^3	1.7×10^3
900	2180	1.61		2.59		1.18		1.12	5.8×10^3	5.8×10^3
900*	2181	1.61		2.53		1.19	5.4×10^3	1.09	4.6×10^3	5×10^3
1100	2182	1.44		2.03	2.2×10^3	0.76	2.4×10^3	0.79	2.4×10^3	2.4×10^3
450†	2183	1.03	16.0	0.88	16.0	0.11	16.0	0.26		16
450‡	2184	1.19	31.0	0.75	24.0	0.15	31.0	0.28		22.6

*Coal dust; all others are ground readings.

†H + 1 hr. + 8 hr.

‡H + 8 hr. + 36 hr.

TABLE 3.18—SMOKY, SLANT-RANGE CALCULATION, SOUTH LINE

Distance from GZ, yd	Elevation above GZ, ft	Slant range, yd
400	-20	466
600	-60	649
800	-80	841
1000	-95	1034
1200	-105	1229
1400	-120	1426
1500	-120	1525
1600	-125	1623
1700	-125	1722
1800	-130	1821
1900	-130	1920
2000	-135	2019

TABLE 3.19—SMOKY, SOUTH GOAL-POST LINE*

Slant distance (D), yd	D ²	Dose in EG&G con- tainer, r	RD ²	No. of EG&G badges per point	Maximum deviation per point, %	Film types read
466	2.17×10^5	$7.60 \times 10^3?$	1.65×10^{11}	2	0	1112
641	7.07×10^5	2.90×10^4	2.05×10^{10}	2	0	1112
1034	1.07×10^6	4.65×10^4	4.97×10^9	2	3.2	1112
1229	1.51×10^6	2.13×10^5	3.22×10^9	2	1.4	1112
1426	2.03×10^6	1.50×10^5	3.05×10^9	2	6.7	1112
1525	2.33×10^6	1.23×10^5	2.86×10^9	2	2.4	1112
1623	2.63×10^6	1.13×10^5	2.97×10^9	2	7.1	1112
1722	2.97×10^6	1.15×10^5	3.42×10^9	2	4.3	1112
1821	3.02×10^6	1.10×10^5	3.32×10^9	2	4.5	1112
1920	3.69×10^6	1.05×10^5	3.87×10^9	2	0	1112
2018	4.07×10^6	9.50×10^4	3.86×10^9	2	5.2	1112
2309	5.33×10^6	0.85	4.53×10^9	2	11.1	502

*Dose vs. distance: RD² vs. D.

TABLE 3.20—GALILEO, GOAL-POST LINE*

Slant distance (D), yd	D ²	Dose in EG&G con- tainer, r	RD ²	No. of EG&G badges per point	Maximum deviation per point, %	Film types read
1228	1.51×10^6	363.8	5.49×10^8	4	10.0	1112; 606
1326	1.76×10^6	262.2	4.97×10^8	4	7.9	1112; 606
1442	2.08×10^6	108.7	2.26×10^8	4	10.4	510
1624	2.64×10^6	79.0	2.09×10^8	2	1.3	510
1673	2.8×10^6	69.8	1.95×10^8	4	6.0	510
2022	4.09×10^6	23.0	9.41×10^7	4	8.7	510
2128	4.53×10^6	14.1	6.39×10^7	1	7.8	502; 510
2222	4.94×10^6	11.5	5.68×10^7	2	0.0	502
3402	1.16×10^7	0.68	7.89×10^8	2	0.0	502

*Dose vs. distance: RD² vs. D.

TABLE 3.21—LA PLACE, GOAL-POST LINE*

Slant distance (D), yd	D^2	Dose in EQ&G container, r	Dose in Li can, r_{Li}	RD^2	$R_{Li} D^2$	No of EQ&G badges per point	Maximum deviation per point, %	No. of Li cans per point	Maximum deviation per point, %	Film types used
659	3.5×10^5	4.5×10^2	2.73×10^2	9.92×10^2	5.52×10^4	4	6.9	2	6.2	1112
791	6.25×10^5	7.5×10^2	5.23×10^2	4.26×10^3	2.93×10^5	4	4.4	2	0.5	1112
1029	1.06×10^6	2.02×10^3	2.6×10^2	2.14×10^3	2.76×10^5	4	3.5	2	0.0	510, 508
1275	1.62×10^6	70.0	10^3	1.13×10^3	1.8×10^5	4	1.4	2	0.0	510
1819	3.31×10^6	26.1		6.03×10^3		4	2.4			510

*Dose vs. distance: RD^2 vs. D.

TABLE 3.22—FIZEAU, GOAL-POST LINE*

Slant distance (D), yd	D ²	Dose in EG&G container, r	RD ²	No. of EG&G badges per point	Maximum deviation per point, %	Film types read
817	6.68×10^5	6.7×10^3	4.48×10^9	4	4.5	1112
1014	1.03×10^6	2.38×10^3	2.45×10^9	4	2.9	1112
1212	1.47×10^6	7.63×10^2	1.12×10^9	4	5.6	1112
1401	1.96×10^6	3.43×10^2	6.83×10^8	4	5.0	606; 1112
1609	2.59×10^6	1.89×10^2	4.9×10^8	4	2.1	570

*Dose vs. distance: RD² vs. D.

TABLE 3.23—SPECIAL STUDIES (Project 39.6a)

Badge No.	Dose, r	Badge No.	Dose, r
390	0	433	5×10^2
420	5.9×10^2	434	4.7×10^2
421	7.5×10^2	435	5.2×10^2
422	5.6×10^2	436	5.9×10^2
423	5.2×10^2	437	5.5×10^2
424	4.9×10^2	440	6×10^2
425	5.3×10^2	441	6.4×10^2
430	5.1×10^2	442	0
431	5.4×10^2	443	0
432	5.7×10^2	444	0

TABLE 3.24—PROJECT 39.6a, BURRO SHELTERS

Project 39.6a No.	Badge No.	Dose, r	Project 39.6a No.	Badge No.	Dose, r
0293	2952	2.8×10^2	2007	3008	4.05×10^2
0276	2953	3.2×10^2		3009	3.75×10^2
0256	2954	2.45×10^2		3010	4.15×10^2
0253	2955	2.6×10^2		3011	3.2×10^2
0299	2956	3.55×10^2		3012	4×10^2
0272	2957	3.3×10^2	3313	3013	4.1×10^2
0258	2958	2.85×10^2		3014	3.9×10^2
0257	2959	3.0×10^2		3015	4.1×10^2
0295	2960	3.2×10^2		3016	4.1×10^2
0278	2961	2.5×10^2		3017	3.7×10^2
0261	2962	3×10^2		3018	4×10^2
0259	2963	2.4×10^2		3019	3.8×10^2
0294	2964	2.7×10^2		3020	4.25×10^2
0280	2965	3.5×10^2		3021	3.6×10^2
	2966	2.65×10^2		3022	3.5×10^2
0264	2967	2.5×10^2		3023	3.6×10^2
0296	2968	3.4×10^2	3025	3024	4.25×10^2
0286	2969	3×10^2		3025	4.35×10^2
	2970	2.6×10^2		3026	4.6×10^2
0254	2971	3.1×10^2		3027	4.2×10^2
0297	2972	3.4×10^2		3832	2.3×10^2
0279	2973	3.4×10^2		3833	2.1×10^2
0270	2974	2.85×10^2		3834	2.05×10^2
0260	2975	3.15×10^2		3835	2×10^2
0298	2976	2.8×10^2		3836	1.95×10^2
0287	2977	3.5×10^2		3837	2.3×10^2
0274	2978	3.6×10^2		3838	2.15×10^2
0262	2979	3.1×10^2		3839	2.4×10^2
0290	2980	3.55×10^2		3840	2.15×10^2
0281	2981	1.75×10^2		3841	1.75×10^2
0273	2982	3.1×10^2		3842	2.1×10^2
0268	2983	2.7×10^2		3843	1.95×10^2
0292	2984	3.45×10^2		3844	1.5×10^2
0285	2985	3.7×10^2		3845	2×10^2
0285	2986	3.15×10^2		3846	1.7×10^2
0255	2987	3.3×10^2		3847	2.3×10^2
0248	2988	3.4×10^2		3848	2.2×10^2
0283	2989	2.8×10^2		3849	2.2×10^2
0275	2990	2.8×10^2		3850	2.3×10^2
0263	2991	3×10^2		3851	2.3×10^2
0291	2992	3.1×10^2		3852	2×10^2
0266	2993	2.75×10^2		3853	2.8×10^2
	2994	2.73×10^2		3854	2.75×10^2
0267	2995	3.3×10^2		3855	2.7×10^2
3099	2996	3.4×10^2		3856	2.65×10^2
0282	2997	3.15×10^2		3857	2.7×10^2
0277	2998	3.55×10^2		3858	2.7×10^2
0265	2999	2.33×10^2		3859	2.4×10^2
3028	3000	3.55×10^2		3860	1.9×10^2
3005	3001	3.55×10^2		3861	2.85×10^2
	3002	3.2×10^2		3862	2.3×10^2
3008	3003	3.0×10^2		3863	3.7×10^2
3006	3004	3.6×10^2		3864	2.2×10^2
	3005	4.05×10^2		3865	2.3×10^2
3003	3006	3.7×10^2		3866	2.3×10^2
3005	3007	2.78×10^2		3867	3.35×10^2

TABLE 3.24—(Continued)

Project 39.6a No.	Badge No.	Dose, r	Project 39.6a No.	Badge No.	Dose, r
	3868	2.3×10^2		4004	2.55×10^2
	3869	2.6×10^2		4005	1.95×10^2
	3870	2.2×10^2		4006	1.9×10^2
	3871	2.9×10^2		4007	1.9×10^2
	3872	3.0×10^2		4008	2.1×10^2
	3873	3.1×10^2		4009	2.15×10^2
	3874	1.9×10^2		4010	1.9×10^2
	3875	2.9×10^2		4011	1.7×10^2
	3876	2.9×10^2		4012	1.55×10^2
	3877	2.8×10^2		4014	1.4×10^2
	3878	3.15×10^2		4015	1.45×10^2
	3879	3.05×10^2		4016	2.65×10^2
	3880	2.55×10^2		4017	1.35×10^2
	3881	2.8×10^2		4018	2.0×10^2
	3882	3.35×10^2		4019	1.8×10^2
	3883	3.1×10^2		4020	2.95×10^2
	3884	2.65×10^2		4021	1.25×10^2
	3885	3.55×10^2		4022	1.15×10^2
	3886	4.1×10^2		4023	1.45×10^2
	3887	3.15×10^2		4024	1.25×10^2
	3888	4.15×10^2		4025	1.3×10^2
	3889	3.65×10^2		4026	2.4×10^2
	3890	3.7×10^2		4027	1.35×10^2
	3891	3.75×10^2		4028	1.7×10^2
	3892	3.4×10^2		4029	1.5×10^2
	3893	3.4×10^2		4030	1.28×10^2
	3894	3.3×10^2		4031	2.8×10^2
	3895	2.9×10^2		4032	1.55×10^2
	3896	4.25×10^2		4033	2.05×10^2
	3897	3.75×10^2		4034	1.75×10^2
	3898	4.65×10^2		4035	2.05×10^2
	3899	3.6×10^2		4036	1.59×10^2
	3900	4.45×10^2		4037	1.4×10^2
	3901	3.6×10^2		4038	1.8×10^2
	3902	4.4×10^2		4039	1.6×10^2
	3903	4.8×10^2		4040	1.55×10^2
	3904	3.1×10^2		4041	1.3×10^2
	3905	3.0×10^2		4042	1.45×10^2
	3906	3.75×10^2		4043	1.7×10^2
	3907	3.9×10^2		4044	1.55×10^2
	3908	3.8×10^2		4045	1.3×10^2
	3909	3.05×10^2		4046	1.2×10^2
	3910	3.0×10^2		4047	1.35×10^2
	3911	4.2×10^2		4048	1.45×10^2
	3992	3.1×10^2		4049	1.5×10^2
	3993	1.7×10^2		4050	1.4×10^2
	3994	2.2×10^2		4051	1.4×10^2
	3995	1.9×10^2		4052	1.65×10^2
	3996	1.95×10^2		4053	1.6×10^2
	3997	2.2×10^2		4054	1.3×10^2
	3998	1.8×10^2		4055	1.8×10^2
	3999	2.35×10^2		4056	1.7×10^2
	4000	1.9×10^2		4057	1.5×10^2
	4001	1.55×10^2		4058	1.40×10^2
	4002	1.9×10^2		4059	1.40×10^2
	4003	1.8×10^2		4060	1.7×10^2

TABLE 3.24—(Continued)

Project 39.6a No.	Badge No.	Dose, r	Project 39.6a No.	Badge No.	Dose, r
	4061	1.6×10^3		4067	1.25×10^3
	4062	1.4×10^3		4068	1.15×10^3
	4063	1.35×10^3		4069	1.2×10^3
	4064	1.4×10^3		4070	1.3×10^3
	4065	1.7×10^3		4071	1.25×10^3
	4066	1.45×10^3			

TABLE 3.25—WHITNEY, GOAL-POST LINE*

Slant distance (D), yd	D^2	Dose in EG&G con- tainer, r	RD^2	No. of EG&G badges per point	Maximum deviation per point, %	Film types read
768	5.9×10^5	9.13×10^3	5.39×10^3	4	4.1	1112
1011	1.02×10^6	2.16×10^3	2.2×10^3	4	4.2	1112
1260	1.59×10^6	6.3×10^3	10^3	4	1.6	1112
1509	2.28×10^6	2.41×10^3	5.49×10^3	4	4.6	608
1760	3.1×10^6	87	2.7×10^3	4	10.3	510

*Dose vs. distance: RD^2 vs. D.

Chapter 4

RECOMMENDATIONS

In order that the films can be handled more effectively and efficiently after a shot, it is recommended that a crew be permanently stationed on site to place badges on short notice, make the fastest possible recovery, and arrange immediate courier delivery of the dosimeters to Las Vegas for processing. In addition, the films could be placed in the field in the evening, be recovered early in the morning in the event of postponement, and be replaced in a large storage reefer for future use. After the shot and calibration films are received in Las Vegas, a second crew would immediately prepare the films for processing and would read and analyze the results for fast preliminary distribution.

Chapter 5

FUTURE ACTIVITIES

In an attempt to better serve the needs of CETO, it is anticipated that EG&G will undertake the following research sponsored by the Division of Biology and Medicine before any future operations:

1. Design and fabrication of a thermal-neutron-shield system
2. Experimentation to evaluate environmental desensitization parameters
3. Rate vs. response studies
4. Absolute processing reproducibility studies involving large numbers of film badges

Appendix

DATA FOR DISTRIBUTED FILM BADGES

The data in Tables A.1 to A.14 represent the interpreted doses of EG&G badges issued to various groups by Project 39.1a and returned to EG&G for processing and analysis. Badges exposed in the field were processed simultaneously with control badges receiving known amounts of gamma radiation. Since large numbers of film badges were issued to various agencies because of participation in several events and since these badges were returned to EG&G with no shot name associated, data are reported with the user's identification number and symbols or with EG&G identification numbers.

TABLE A.1—FALLOUT BADGE STUDY (Program 37)

Badge No.	Dose, r	Badge No.	Dose, r	Badge No.	Dose, r
3032	7	3061	2.30	3125	0
3033	0.48	3062	2.30	3126	0
3035	0.65	3064	1.40	3127	0
3036	1.90	3065	1.70	3128	0
3037	0.03	3067	0.24	3129	0
3038	≤ 0.03	3068	1.70	3130	0.04
3039	≤ 0.03	3070	1.50	3131	0
3040	≤ 0.03	3071	0.10	3132	0
3041	≤ 0.03	3073	0	3133	0
3042	0.90	3074	0	3134	0
3043	3.90	3076	0	3135	0.04
3044	≤ 0.03	3079	0	3136	0
3045	2.10	3112	0	3137	0
3046	≤ 0.03	3113	0	3138	0
3047	0.80	3114	0.04	3139	0
3048	0.10	3115	0	3140	0
3049	0.04	3116	0.06	3141	0
3050	≤ 0.03	3117	0	3142	0
3051	2.10	3118	0	3143	0
3052	≤ 0.03	3119	0.04	3144	0.04
3053	≤ 0.04	3120	0	3145	0.24
3055	0.08	3121	0	3146	0.04
3056	≤ 0.03	3122	0	3147	0
3058	≤ 0.03	3123	0	3148	0.19
3059	1.70	3124	0	3149	0

TABLE A.1 — (Continued)

Badge No.	Dose, r	Badge No.	Dose, r	Badge No.	Dose, r
3150	0.08	3207	0.04	3264	0.08
3151	0.24	3208	0	3265	0.10
3152	0.24	3209	0.04	3266	0.24
3153	0.24	3210	0.35	3267	0.24
3154	0.48	3211	0.24	3268	0.04
3155	0.19	3212	0.24	3269	0
3156	0.48	3213	0.48	3270	0.04
3157	0.04	3214	0.24	3271	0
3158	0.19	3215	0.10	3272	0
3159	0.15	3216	0.48	3273	0.19
3160	0.08	3217	0.40	3274	0
3161	0.08	3218	0.10	3275	12.5
3162	0.08	3219	0.15	3276	1.00
3163	0.08	3220	0.24	3277	0.20
3164	0.10	3221	0.24	3278	0
3165	0.10	3222	0.35	3279	5.40
3166	0.15	3223	0.40	3280	0.70
3167	0.15	3224	0.24	3281	8.00
3168	0.10	3225	0.40	3282	0
3169	0.15	3226	0.35	3283	0
3170	0.15	3227	0.24	3284	1.40
3171	0.19	3228	0.24	3285	0
3172	0.10	3229	0.48	3286	0
3173	0.10	3230	0.24	3287	0
3174	0.10	3231	0.10	3288	0
3175	0.10	3232	0.10	3289	0
3176	0.08	3233	0.10	3290	0
3177	0.10	3234	0.10	3291	1.80
3178	0.10	3235	0.10	3292	0.24
3179	0.08	3236	0.19	3293	0
3180	0.24	3237	0.15	3294	1.70
3181	0.27	3238	0.19	3295	0
3182	0.24	3239	0.24	3296	1.70
3183	0.19	3240	0	3297	0
3184	0.15	3241	0	3298	7.00
3185	0.90	3242	0.48	3299	0
3186	0.24	3243	0.48	3300	0
3187	0.15	3244	0	3301	0.04
3188	0.27	3245	0	3302	0
3189	0.70	3246	0	3303	0.04
3190	0.24	3247	0	3304	0.08
3191	0.24	3248	0	3305	0
3192	0.24	3249	0	3306	7.90
3193	0.24	3250	0.10	3307	1.80
3194	0.27	3251	0.09	3308	0
3195	0.24	3252	0.08	3309	50.0
3196	0.15	3253	0.08	3310	0
3197	0.10	3254	0.15	3311	0
3198	0.15	3255	0.15	3312	0
3199	0.10	3256	0.24	3313	0
3200	0	3257	0.08	3314	0.08
3201	0	3258	0.10	3315	0
3202	0.08	3259	0.10	3316	0.70
3203	0	3260	0.10	3317	0.70
3204	0	3261	0.15	3318	0.48
3205	0.08	3262	0.19	3319	3.50
3206	0.08	3263	0.19	3320	0
				3321	0.10
				3322	0.54
				3323	1.90
				3324	0.04
				3325	0
				3326	0
				3327	0
				3328	0

TABLE A.1 — (Continued)

Badge No.	Dose, r	Badge No.	Dose, r	Badge No.	Dose, r
3329	3.50	3919	0.075	4080	0.075
3331	0	3922	0.075	4081	2.50
3332	0.54	3923	0.12	4082	0.075
3336	0.04	3924	0.075	4093	0.04
3338	0.04	3927	0.04	4094	0.02
3341	0.03	3931	0.1	4096	0.10
3345	0.10	3932	0.12	4096	0.075
3348	50.0	3933	0.1	4097	0.10
3629	0.56	3934	0.01	4099	0.01
3630	0.45	3935	0.01	4099	0.01
3631	0.20	3938	0.12	4100	0.01
3632	0.40	3942	0.01	4101	0.01
3634	0.075	3943	0.15	4109	0.20
3635	0.075	3944	0.01	4109	0
3645	0.04	3945	0.04	4110	0.15
3646	0.04	3946	0.04	4111	0
3647	0.075	3949	0.26	4112	0.01
3650	0.075	3950	0.40	4113	0.175
3651	0.10	3952	0.26	4115	0.20
3652	0.10	3953	0.175	4116	0
3653	0.075	3954	0	4117	0.20
3658	0.075	3956	0.26	4120	0.175
3659	0.04	3960	0	4121	0.175
3661	0.04	3961	0.01	4122	0.12
3663	0.04	3962	0.26	4124	0.10
3664	0.075	3966	0.075	4125	2.75
3665	0.04	3967	0.075	4126	0.70
3666	0.04	3968	0.1	4127	0.175
3667	0.04	3978	0.075	4130	0.175
3668	0.10	4072	0.04	4139	0.04
3670	0	4075	0.075	4141	0.075
3671	0.15	4076	0.04	4142	0.075
3912	0.075	4077	0.04	4143	0.10
3913	0.075	4078	0.12	4144	0.10
3914	0.075	4079	0.12	4145	0.26
3915	0.075	4081	0.075	4147	0.10
3916	0.075	4084	0.01	4148	0.075
3917	0.12	4085	0.075	4149	0.075
3918	0.075	4088	0.04	4150	0.15
				4151	0.075

TABLE A.2—FALLOUT BADGE STUDY (Program 37)

Badge No.	Dose, r	Badge No.	Dose, r
1661	0.07	1843	0.01
1662	0.09	1844	0.05
1663	0.09	1845	0.03
1664	0.03	1846	0.05
1665	0.03	1847	0.07
1667	0.05	1848	0.03
1668	0.03	1849	0.07
1671	0.03	1850	0.07
1672	0.05	1851	0.07
1673	0.07	1852	0.03
1675	0.05	1853	0.01
1676	0.05	1854	0.03
1677	0.05	1855	0.03
1678	0.05	1856	0.05
1679	0.09	1857	0.03
1680	0.05	1858	0.03
1683	0.05	1859	0
1684	0.05	1870	0
1688	0.01	1871	0
1691	0.03	1872	0
1692	0.03	1873	0
1693	0.03	1874	0
1821	0.01	1875	0.01
1822	0.01	1876	0
1823	0.01	1877	0
1824	0.03	1878	0
1825	0.03	1879	0
1828	0	1880	0
1829	0	1881	0.03
1840	0.01	1882	0
1841	0.01	1884	0.03
1842	0.01	1885	0.01

TABLE A.3—PROJECT TERRY-2 (Program 37)

Station	Position	Badge No.	Dose, r
0206	GV	1684	0
0206	GH	1879	0
0206	3'V	1683	0.02
0206	3'H	1873	0
0206	3'B	1874	0
0210	GV	1882	0
0210	GH	1879	0
0210	3'V	1880	0
0210	3'H	1688	0
0210	3'B	1885	0.02
0214	GV	1881	0
0214	GH	1876	0
0214	3'V	1884	0
0214	3'H	1875	0
0214	3'B	1877	0
0218	GV	1690	0.02
0218	GH	1870	0
0218	3'V	1693	0
0218	3'H	1871	0
0218	3'B	1872	0
Control		1691	0
Control		1692	0

TABLE A.4—PROJECT TERRY-3 (Program 37)

Station	Position	Badge No.	Dose, r
0306	GV	1848	0
0306	GH	1855	0.02
0306	3'V	1850	0
0306	3'H	1858	0.04
0306	3'B	1859	0
0310	GV	1856	0.04
0310	GH	1851	0.02
0310	3'V	1857	0
0310	3'H	1854	0.02
0310	3'B	1852	0
0314	GV	1844	0.04
0314	GH	1847	0.02
0314	3'V	1849	0.06
0314	3'H	3068	1.09
0314	3'B	3071	0.09
0318	GV	1843	0.02
0318	GH	1846	0.02
0318	3'V	1845	0.02
0318	3'H	1853	0.02
0318	3'B (33277)		0.06
Control		1840	0
Control		1841	0
Control		1842	0

TABLE A.5—PROJECT TERRY-4 (Program 37)

Station	Position	Badge No.	Dose, r
0406	GV	1824	0
0406	GH	1823	0
0406	3'V	1821	0
0406	3'H	1822	0.02
0406	3'B	1825	0
0410	GV	1677	0.04
0410	GH	1679	0.02
0410	3'V	1675	0
0410	3'H	1678	0.02
0410	3'B	1676	0.02
0414	GV	1667	0.02
0414	GH	1672	0.02
0414	3'V	1668	0.04
0414	3'H	1671	0.02
0414	3'B	1673	0
0418	GV	1664	0.02
0418	GH	1662	0.02
0418	3'V	1665	0
0418	3'H	1663	0.04
0418	3'B	1661	0.02
Control		1828	0
Control		1829	0

TABLE A.6—PROJECT TERRY-5 (Program 37)

Station	Position	Badge No.	Dose, r
0506	GV		
0506	GH	3048	0.10
0506	3'V		
0508	3'H	3055	0.57
0508	3'B	3073	0
0510	GV		
0510	GH	3039	0
0510	3'V		
0510	3'H	3070	0.15
0510	3'B	3076	0
0514	GV		
0514	GH	3290	0
0514	3'V		
0514	3'H	3044	0
0514	3'B	3067	0.18
0518	GV	3052	0
0518	GH	3326	0.10
0518	3'V	3341	0.07
0518	3'H	3310	0
0518	3'B	3072	0
Control		3053	0
Control		3074	0
Control		3058	0
Control		3297	0
Control		3288	0
Control		3056	0
Control		3293	0
Control		3049	0

TABLE A.7—PROJECT TERRY-6 (Program 37)

Station	Position	Badge No.	Dose, r
0606	G	3064	0
0606	B	3324	0
0606	B	3276	0
0610	G	3042	0
0610	B	3318	0
0610	B	3286	0
0614	G	3059	0.15
0614	B	3061	0.80
0614	B	3294	0
0618	G	3062	0.80
0618	B	3351	0.50
0618	B	3045	0.80
Control		3045	0
Control		3317	0

TABLE A.8—PROJECT TERRY-7 (Program 37)

Station	Position	Badge No.	Dose, r
0706	G	3277	7.4
0706	B	3298	6.1
0706	B	3291	7.4
0710	G	3275	10.4
0710	B	3309	30
0710	B	3348	35
0714	G	3314	5.4
0714	B	3032	6.1
0714	B	3279	4.6
0718	G	3043	3.1
0718	B	3320	3.1
0718	B	3329	3.4
Control		3332	0
Control		3319	0

TABLE A.9—PROJECT TERRY-8 (Program 37)

Station	Position	Badge No.	Dose, r
0806	G	3338	0
0806	B	3304	0
0806	B	3300	0
0810	G	3336	0
0810	B	3284	0
0810	B	3308	0
0814	G	3307	1.60
0814	B	3325	1.80
0814	B	3291	1.50
0818	G	3036	1.90
0818	B	3306	1.60
0818	B	3299	1.40
Control		3301	0
Control		3345	0

TABLE A.10—PROJECT TERRY-9 (Program 37)

Station	Position	Badge No.	Dose, r
0906	G	3280	0.57
0906	B	3035	0.70
0906	B	3047	0.70
0910	G	3273	0
0910	B	3292	0.06
0910	B	3033	0.40
0914	G	3223	0
0914	B	3302	0
0914	B	3322	0
0918	G	3303	0
0918	B	3315	0
0918	B	3305	0
Control		3237	0
Control		3331	0

TABLE A.11—PROJECT TERRY-10 (Program 37)

Station	Position	Badge No.	Dose, r
1006	G	3312	0
1006	B	3313	0
1006	B	3328	0
1010	G	3046	0
1010	B	3271	0
1010	B	3272	0
1014	G	3278	0.02
1014	B	3038	0.02
1014	B	3040	0
1018	G	3041	0
1018	B	3050	0
1018	B	3287	0
Control		3037	0
Control		3283	0

TABLE A.12—WHIRLIGIG (Program 35)

Badge No.	Dose, r	Badge No.	Dose, r
3289	1.0	3338	1.0
3311	1.25	3343	1.25
3316	0.95	3344	1.25
3321	1.0	3347	1.2
3330	0.95	3349	1.25
3333	1.1	3350	1.25

TABLE A.13—PROJECT 35.1

Location	Badge No.	Dose, r
3 August 1400:		
10 ft north of pad	439	200
10 ft south of pad	419	200
Lower arm of tower, 3-ft elevation	447	157.5
100 ft west of pad	446	207.5
100 ft south of pad	445	100
200 ft west of pad	413	205
200 ft south of pad	428	207.5
200 ft east of pad	448	225
100 ft east of pad	426	207.5
200 ft north of pad	409	207.5
100 ft north of pad	427	212.5
10 ft north, 2 in. deep	429	0
10 ft south, 2 in. deep	449	0
7 August 1500:		
Height: 9 ft, lower side arm, 41 in. from tower	3351	140
Height: 9 ft, lower side arm, 27 in. from tower	3339	134
Height: 9 ft, lower side arm, 14 in. from tower	3342	134
Height: 3 ft, lower side arm, 41 in. from tower	3324	150
Height: 3 ft, lower side arm, 27 in. from tower	3337	143
Height: 3 ft, lower side arm, 14 in. from tower	3340	147.5

TABLE A.14—AFSWP-DOD BADGES
(Project 2.10)

Badge No.	Dose, r*	Badge No.	Dose, r*
1741	9.0×10^3	1748	2.5×10^3
1742	2.7×10^3	2179	1.25×10^3
1743	5.0×10^4	2180	460
1744	1.0×10^4	2181	450
1745	9.0×10^3	2182	240
1746	9.0×10^3	2183	19
1747	5.1×10^3	2184	31

*From the extrapolated portion of the curve.

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Commandant, School of Aviation Medicine, USAF, Randolph AFB, Tex. ATTN: Research Secretariat	161
Commander, 1609th Special Weapons Squadron, Headquarters, USAF, Washington 25, D. C.	162
Commander, Wright Air Development Center, Wright-Patterson AFB, Dayton, Ohio. ATTN: WCOSI	163-165
Director, USAF Project RAND, VIA: USAF Liaison Office, The RAND Corp., 1700 Main St., Santa Monica, Calif.	166-167
Commander, Air Defense Systems Integration Div., L. G. Hanscom Field, Bedford, Mass. ATTN: SIDE-S	168
Chief, Ballistic Missile Early Warning Project Office, 220 Church St., New York 13, N. Y. ATTN: Col Leo V. Skinner, USAF	169
Commander, Air Technical Intelligence Center, USAF, Wright-Patterson AFB, Ohio. ATTN: AFCTN-481a, Library	170
Assistant Chief of Staff, Intelligence, Headquarters, USAF, APO 633, New York, N. Y. ATTN: Directorate of Air Targets	171
Commander, Alaskan Air Command, APO 942, Seattle, Wash. ATTN: AAOTN	172
Commander-in-Chief, Pacific Air Forces, APO 953, San Francisco, Calif. ATTN: PFCIE-MIA, Base Recovery	173

OTHER DEPARTMENT OF DEFENSE ACTIVITIES

Director of Defense Research and Engineering, Washington 25, D. C. ATTN: Tech. Library	174
Executive Secretary, Military Liaison Committee, P.O. Box 1814, Washington 25, D. C.	175
Director, Weapons Systems Evaluation Group, Room 1E560, The Pentagon, Washington 25 D. C.	176
Commandant, The Industrial College of The Armed Forces, Ft. McNair, Washington 25, D. C.	177
Commandant, Armed Forces Staff College, Norfolk 11, Va. ATTN: Secretary	178
Chief, Defense Atomic Support Agency, Washington 25, D. C.	179-186
Commander, Field Command, DASA, Sandia Base, Albuquerque, N. Mex.	187
Commander, Field Command, DASA, Sandia Base, Albuquerque, N. Mex. ATTN: FCTG	188
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Commander, JTF-7, Arlington Hall Station, Arlington 12, Va.	194
Administrator, National Aeronautics and Space Administration, 1520 H St., NW, Washington 25, D. C. ATTN: Mr. R. V. Rhode	195
U. S. Documents Officer, Office of the United States Nation's Military Representative, SMAPE, APO 55, New York, N. Y.	196

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ATOMIC ENERGY COMMISSION ACTIVITIES

U. S. Atomic Energy Commission, Tech. Library, Washington 25, D. C. ATTN: For DMA
Los Alamos Scientific Laboratory, Report Library, P.O. Box 1663, Los Alamos, N. Mex.
ATTN: Helen Redman
Sandia Corporation, Classified Document Division, Sandia Base, Albuquerque, N. Mex.
ATTN: H. J. Smyth, Jr.
University of California Lawrence Radiation Laboratory, P.O. Box 808, Livermore, Calif.
ATTN: Clovis G. Craig
Weapon Data Section, Technical Information Service Extension, Oak Ridge, Tenn.
Technical Information Service Extension, Oak Ridge, Tenn. (Surplus)

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ADDITIONAL DISTRIBUTION

Office of Civil and Defense Mobilization, Security Officer, Operational Headquarters,
Battle Creek, Mich. ATTN: Rollin U. Brannan, Jr.

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Defense Nuclear Agency
6801 Telegraph Road
Alexandria Virginia 22310-3398

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ISST

29 March 1996

MEMORANDUM FOR DEFENSE TECHNICAL INFORMATION CENTER
ATTENTION: OCD Mr. Bill Bush

SUBJECT: Declassification of AD-339487L and Withdrawal of AD-A995091

The Defense Nuclear Agency Security Office (OPSSI) has declassified and approved for public release (distribution statement "A") the following report:

AD-339487L (WT-1466).

Since the original report (AD-339487L) is declassified and approved for public release, this office requests the removal of the extracted version (AD-A995091, WT-1466-EX) from the DTIC system. The extracted version (AD-A995091) is now obsolete and should no longer be sold.

Josephine B. Wood
JOSEPHINE B. WOOD
Chief, Technical Support

ERRATA

AD-339487



Defense Nuclear Agency
6801 Telegraph Road
Alexandria, Virginia 22310-3398

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29 March 1996

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